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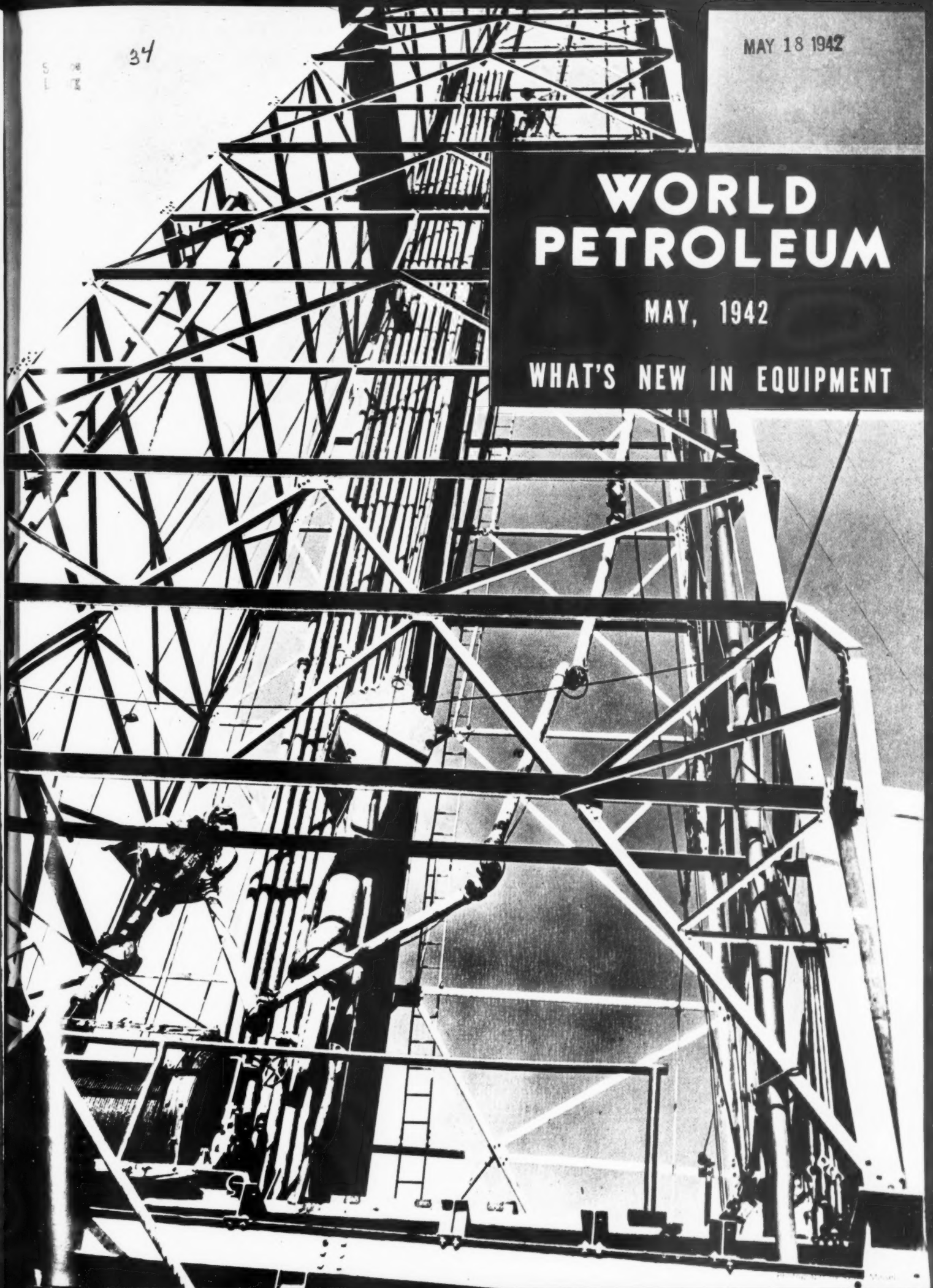
WORLD PETROLEUM

MAY, 1942

WHAT'S NEW IN EQUIPMENT

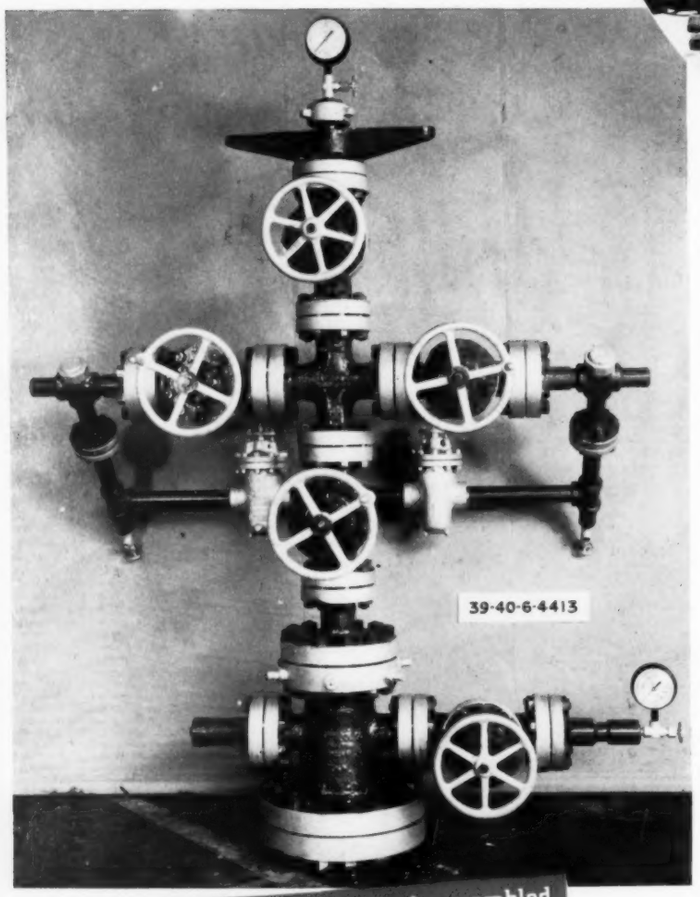


Announcing

O·C·T Rebuilt CHRISTMAS TREE SERVICE

You send us this
We'll send you this

Your old tubing heads, valves and fittings . . regardless of make.



A completely re-worked, assembled and tested Christmas tree . . . good as new.

Here's a plan designed to aid the nation's drive to conserve precious steel and to assist you in converting your old, dismantled Christmas trees into usable equipment. The accompanying pictures show what can be done with tubing heads, valves and fittings that have been removed from wells and stacked away. Each unit is carefully inspected and new parts installed when required. Valves are torn down, inspected and overhauled. Suggested assembly drawings, utilizing all salvageable parts, are furnished, or the rebuilt trees will be assembled to your own specifications. Each tree is tested to full rated pressure, painted, mounted on skids and delivered to you in first class condition.

Take inventory of your used equipment. Chances are that you have valuable parts or complete trees that could be safely used on your future wells.

OIL CENTER TOOL COMPANY

HOUSTON, TEXAS, U·S·A

QUALITY O·C·T PRODUCTS
"Selling Through Leading Supply Stores"

Export Representative: Val R. Wittich, 30 Rockefeller Plaza, New York, N. Y.

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WORLD PETROLEUM

Incorporating Petroleum Equipment Exporter

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

VOLUME 13 | MAY, 1942 | NUMBER 5

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Rex W. Wadman
General Manager

E. W. Mayo
Editor

E. W. Mayo, Jr.
Managing Editor

S. J. Gallay
Advertising Manager

Heyworth Campbell
Art Director

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CORRESPONDENCE

ADDRESS all correspondence regarding editorial, advertising and subscription matters to 2 West 45th Street, New York, N. Y. Telephone Murray Hill 2-7333.

Published monthly by the estate of Russell Palmer, 34 Crystal Street, East Stroudsburg, Pa.

London office: Brettenham House, Lancaster Place, W.C.2.

Pacific Coast office: Don F. Harner, 1595 Pacific Avenue, Long Beach, California. (Tel.: 613-238)

SUBSCRIPTIONS

Annual subscription is offered at the flat rate of $5.00 (U.S.) postpaid. Single copies are obtainable at 50 cents.

EDITORIAL

OIL INDUSTRY MAINTAINS ITS TECHNICAL PROGRESS

SWIFT expansion of the war program with its ever increasing absorption of structural materials and its steadily growing demands upon transportation facilities has impinged upon the oil industry in a number of ways. Imperative requirements of steel and other metals for ships and armament production plants have restricted drilling at a time when the development of new fields is particularly important. Provision of larger supplies of the petroleum products essential to war use has changed the established balance in refining practice. Requisitioning of tankers for military purposes has deprived the industry of transportation equipment, threatening a possible shortage of products in certain sections of the country at a time when a plethora of supplies raises a serious problem in other areas.

In passing it may be worth while to note that these obstacles to the normal functioning of the industry all have been created by factors beyond its own authority. So far as rested within its own control the oil industry has been prepared at all times to meet the extraordinary demands put upon it by expanding war requirements without serious interruption of its service to the industrial community and the civilian population. It is of little use now to discuss ways and means by which present handicaps might have been avoided but it is of practical importance that the industry itself and the governmental agencies concerned with the problems of oil are working diligently to overcome these obstacles and to adapt the industry's operations to the new conditions that prevail with a minimum amount of interference with its regular service to the public.

In this connection it is encouraging to note that one phase of petroleum development in which no slackening of effort has been permitted to take place is that of research. The organizations built up by the oil companies for study and experimentation engage the services of thousands of scientists and technical experts and involve the expenditure of hundreds of millions of dollars yearly. It is to the credit of the companies that despite the heavy demands upon them and the prospect of diminishing revenues this special activity has not been allowed to lag. While some valuable workers have been drawn off to military service few studies have been suspended and there has been an intensification of effort on the part of their fellows who are laboring enthusiastically to extend their contributions to the nation's strength and to the winning of the war.

To appreciate the vital importance that attaches to the tedious and intricate labors of the men engaged in laboratory studies and experiment it is necessary only to glance at the bearing of a few of their past discoveries upon the conduct of the present war. When the first insignificant amount of iso-octane was produced as a result of long and costly experimentation it might have seemed that the undertaking was scarcely worth while. It was a laboratory curiosity for which no commercial demand existed, but today it provides the fuel essential to the air superiority that is counted upon to bring victory to the United Nations. The demonstration that rubber could be produced by a synthesis of petroleum was of small immediate significance at the time it was made because the natural product was cheaper and in abundant supply. Today, with that supply cut off, the oil industry is called upon to satisfy the nation's rubber requirements. A whole wide range of chemicals urgently required for the manufacture of munitions and otherwise unobtainable in sufficient quantity are being supplied by the petroleum industry because of laboratory studies conducted long before the need for these special products had made itself evident.

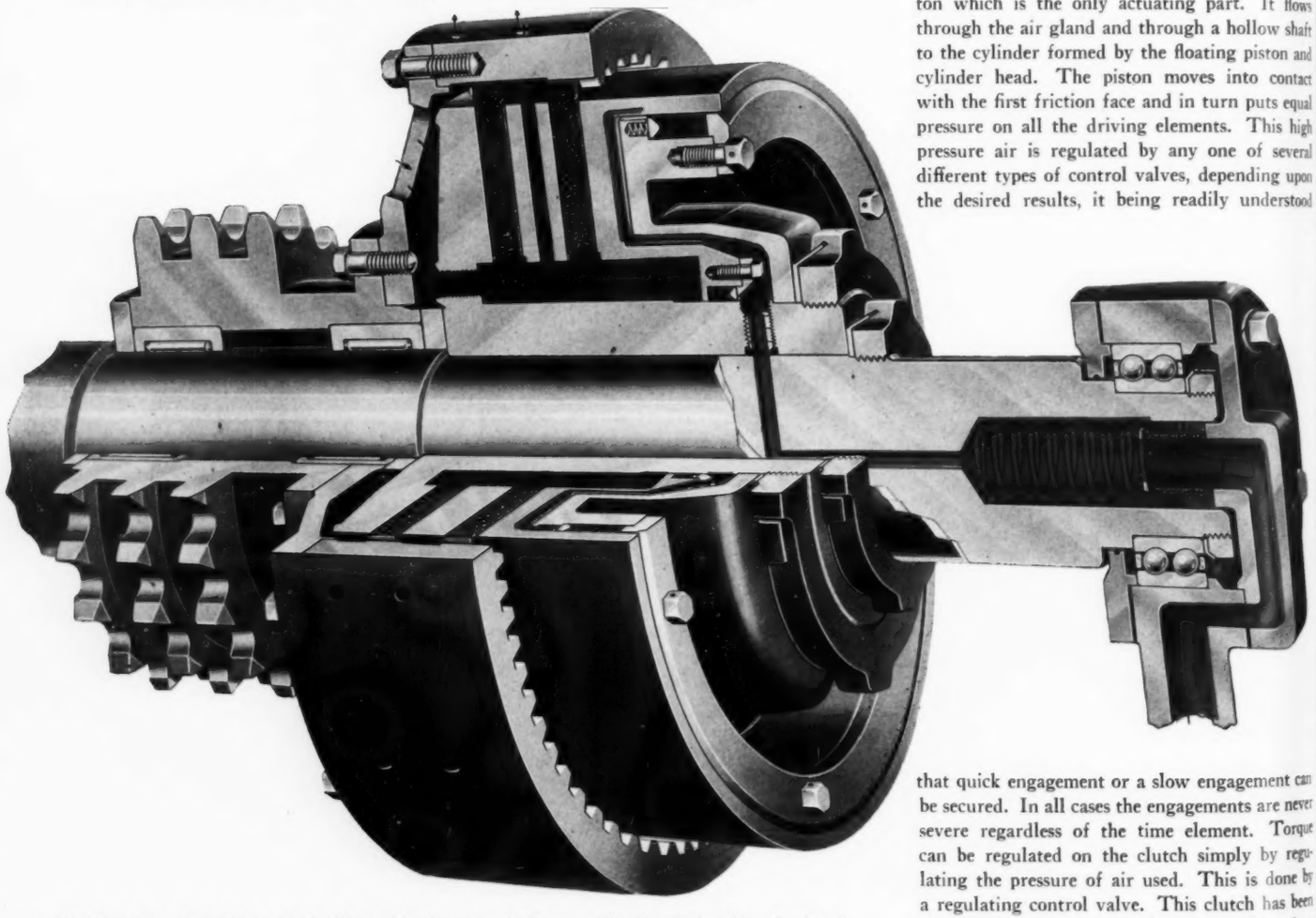
It is not merely in providing the direct materials of war however that the research group of the petroleum industry is demonstrating the indispensable character of its work. Its members are busily engaged in providing acceptable substitutes for materials made scarce or unavailable because of war conditions such as linings for metal cans which will replace the vanishing tin container, coatings for metal parts more wear resistant than anything in use heretofore and a thousand and one other products which enter into daily use or alleviate scarcities resulting from present disturbed conditions. In fact there appears to be no limit to the variety of useful things that the petroleum chemist can produce from his magic test tubes if the demand arises.

While participating wholeheartedly and in many important ways in the war effort the petroleum industry and its closely related equipment industry is not neglecting the improvement of its own processes and machinery as the record of progress presented in the following pages of this issue attests. This is important too, even though it may be impossible to bring into immediate production all the improvements developed. Once the present emergency has passed the oil industry will face a tremendous task of reconstruction and expansion in all parts of the globe such as it never before has confronted. Every advance in method, every mechanical facility that will contribute to the speed. economy and efficiency with which this task can be performed will be of vastly enhanced value to originators and users alike.

WHAT'S NEW IN PETROLEUM EQUIPMENT

This year a new factor of tremendous importance to national welfare must be considered in studying the new equipment, the improvements and refinements in design developed over the past year by manufacturers of petroleum equipment: conservation of steel, manpower and time no longer mean only commercial success — such savings will contribute to the early and victorious conclusion of the war. New equipment will not be as readily available during the war years as it has been in the past. But even greater quantities of petroleum and products will be needed to supply the armies and industries of the United Nations. The research and ingenuity of equipment manufacturers as reflected in the pages of this third annual "What's New in Petroleum Equipment" issue of World Petroleum will assist materially in producing the required quantities of petroleum with the economy and efficiency that the war demands.

UNIT RIG AND EQUIPMENT COMPANY



The Unit Rig Air-O-Matic clutch: blue colored portion indicates self-induced air; the red colored portion shows high pressure air which operates the piston, the only actuating part.

THIS Unit Rig Air-O-Matic Clutch, highly developed and time proved, is now being shown in detail since the patent has been granted on its salient features. Engineers of the Unit Rig and Equipment Company several years ago realized that to handle this unusually severe type of work involved in drilling and servicing a clutch must of necessity be simple in design, of large capacity and rugged in construction. Manually controlled clutches were practical for limited horsepower, but in many cases were primarily designed for industrial service and not for oilfield use. The problems to be overcome in designing a new clutch were, elimination of surplus parts and simplification of adjustment. Since the disc clutch is almost universally used in industrial fields, it was considered by the Unit Rig engineers to be the best basic clutch with which to start. The Air-O-Matic clutch is of the direct air-actuated type and is not to be confused with air-controlled type clutches. It is made extra heavy for heat absorption, and is mechanically rugged.

A unique self-induced air system is employed for cooling the springs and floating or center plates as well as keeping all friction surfaces clean, the latter occurring when clutch is disengaging. This can be understood by following the arrows on the blue colored portions of the accompanying illustration which indicates the self-induced air. The high pressure air indicated in red operates the piston which is the only actuating part. It flows through the air gland and through a hollow shaft to the cylinder formed by the floating piston and cylinder head. The piston moves into contact with the first friction face and in turn puts equal pressure on all the driving elements. This high pressure air is regulated by any one of several different types of control valves, depending upon the desired results, it being readily understood that quick engagement or a slow engagement can be secured. In all cases the engagements are never severe regardless of the time element. Torque can be regulated on the clutch simply by regulating the pressure of air used. This is done by a regulating control valve. This clutch has been used for hoisting, driving the rotary table where torque was definitely controlled, driving the slush pumps and connecting drilling rig engines to the driving system of a four wheel drive truck. These varying operations indicate its wide range of adaptability. An important advantage of this clutch, as used in drilling equipment, is the fact that all equipment driven by the clutch is greatly favored—there are no shocks.

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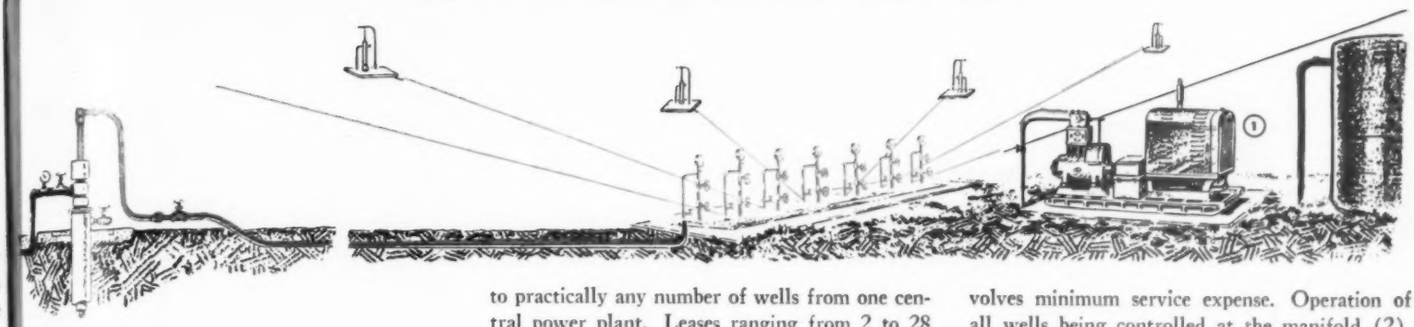
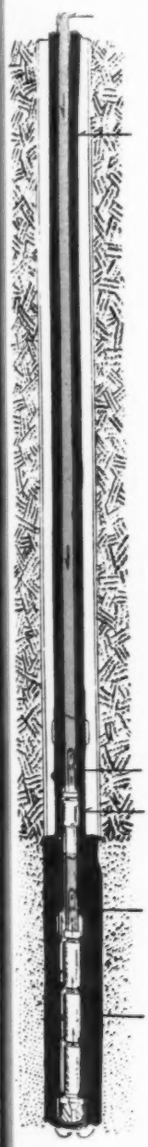
KOBE MULTIPLE WELL PUMPING

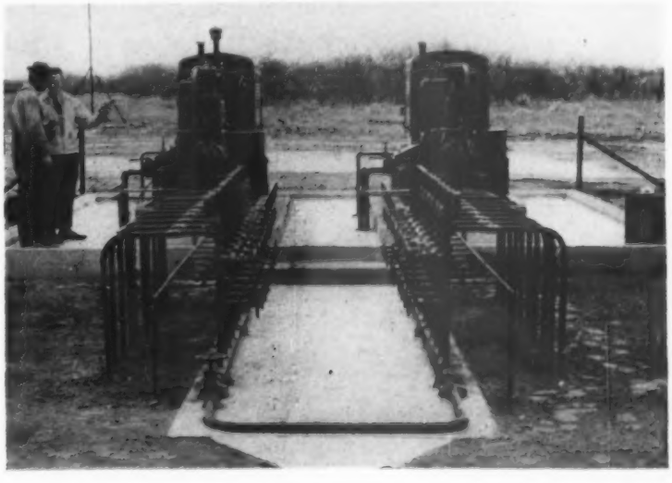




THE Kobe Hydraulic Multiple Well Pumping System is of prime interest to oil producers because it offers many opportunities for effective conservation of capital, equipment, labor and power, and of steel that is much needed now. The Kobe System is adapted to both single well operation, and for multiple pumping of from two to practically any number of wells from one central power plant. Leases ranging from 2 to 28 wells are now being produced successfully, depths ranging from a few hundred to 8,700 ft. The present range of equipment includes depths to 15,000 ft., and volumes up to 4,500 bbl. per day.

Pumping 20 or more wells from one central plant clearly illustrates the savings that are possible in equipment, as well as in operation and maintenance. Capital investment is kept to an absolute minimum at every period during the life of a property, and better fitting of the equipment to actual pumping needs is possible, as the hydraulic power units are self-contained and complementary, and can be added or removed to meet continuously changing conditions as they develop. At the start of operations, only the initial low horsepower requirements need be provided. As horsepower requirements increase, additional one-piece power units can be added by a few simple pipe connections; and as dead wells are abandoned the horsepower which they previously used can be re-directed and used on new wells or wells of larger volume, as desired, with no sacrifice whatever of original equipment. Excessive initial investment, due to limited knowledge regarding the future characteristics of the property, thus are entirely avoided. Any one or more of the wells in a multiple installation can be produced at the same time from the central control, or any number can be closed down while the remaining wells are produced to maximum capacity for emergency requirements. Low operating costs for the entire lease are thus assured. Location of power units and prime movers at one central point (1) involves minimum service expense. Operation of all wells being controlled at the manifold (2), the pumper is relieved of the necessity of visiting individual well locations for any purpose other than general maintenance. Individual well head connections (3) are extremely simple, and there is nothing at all to get out of order or require attention during regular operation. Centralized control also provides a simple method of daily checks and adjustment of individual well operations. Bottom hole pressures, pumping fluid levels, and other important factors can be quickly determined, providing a constant knowledge of down-hole pumping conditions.

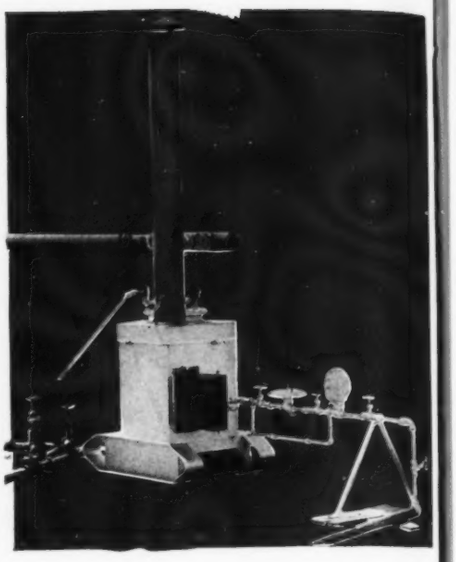
Kobe hydraulic power transmission also eliminates the need for heavy mechanical linkage and counterbalancing, which, together with concentration of power units and centralizing of power controls, greatly reduces the amount of steel per pumping unit. Savings of 30 to 85 percent in steel ordinarily required to pump an oil well, therefore, can be made. The largest savings are of course on multiple well installations, frequently making it possible to pump seven wells with the same amount of steel previously required to pump one well. Extraordinary flexibility of equipment permits fitting production rates precisely to changing well conditions. In addition, individual well operation can be increased or decreased by the simple process of adjusting a valve at the central plant. Individual pump capacities can be greatly enlarged by increasing the pump speeds, and also by substituting larger pump ends. Fluid recoveries can be precisely controlled in accordance with formation conditions.



Illustrated at the top and left hand side of this page is a diagrammatic hook-up of Kobe Multiple well pumping. At right is shown a two unit power plant as it appears on the surface.

Parkersburg Rig and Reel Company

THE Parkersburg Rig and Reel Company's heaters one of which is illustrated on the right, have been so designed that their operation depends entirely on radiation. This is a very loosely used term which when applied in its true meaning gives the basic design of a heater—a means of adding heat to a fluid without greatly raising the temperature of the container (tubes usually) holding the fluid. Of all three processes of heat transmission, i.e., conduction, convection and radiation, only radiation can be utilized to maintain high heat transfer rates with a minimum tube temperature. To assure high efficiency and absorb radiant energy to attain heat it is necessary to achieve complete combustion. The burners employed in Parkersburg heaters achieve this by utilizing the energy of one fluid to inspirate another. By so doing, flame impingement is eliminated and all burning gases are completely burned within the burner itself. There are no fixed crown of flue sheets in a Parkersburg heater. The tube cluster is not welded to rigid supports and normal tube creep caused by excessive heating and cooling of tubes cannot damage them. Tube creep is only natural in any type of heating equipment. However, the full-floating tubes in Parkersburg heaters do not cause excessive stresses and therefore tube life is increased considerably. Furthermore, all tube surfaces face a refractory wall and, since hot gases do not impinge upon the tubes, even tube temperature is attained—thus equal distribution of the heat load is assured and the possibilities of destructive hot spots on tubes are eliminated. Due to the nature of their design, Parkersburg heaters require 50 percent to 75 percent less tube-water surface than ordinary heaters. Therefore, they are 38 percent to 50 percent smaller than most heaters and in many cases as much as 58 percent less in weight. These advantages make the complete unit small and compact to facilitate installation and moving costs.



Hook up of the Parkersburg Rig and Reel Company heater.

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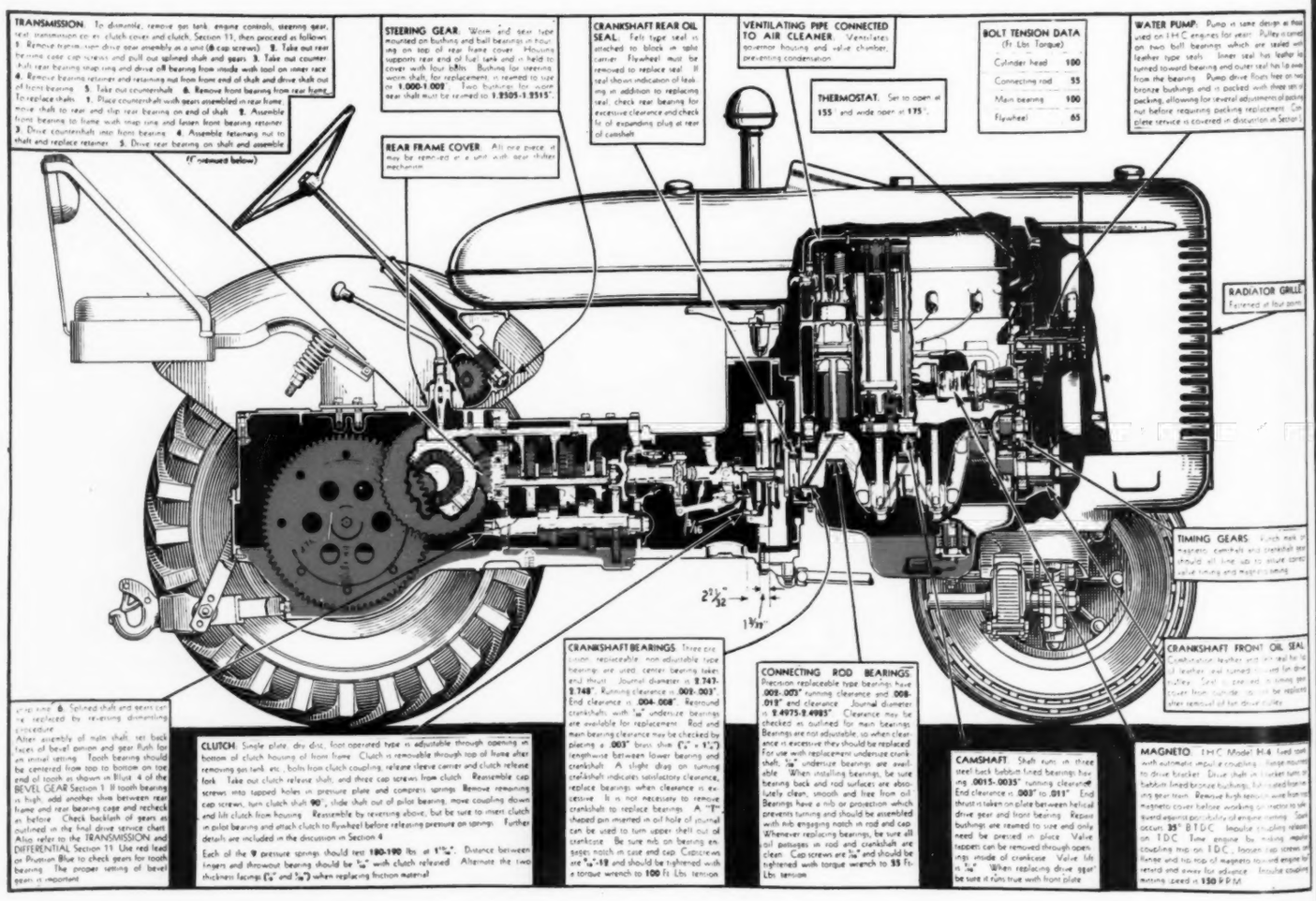
International Harvester Company

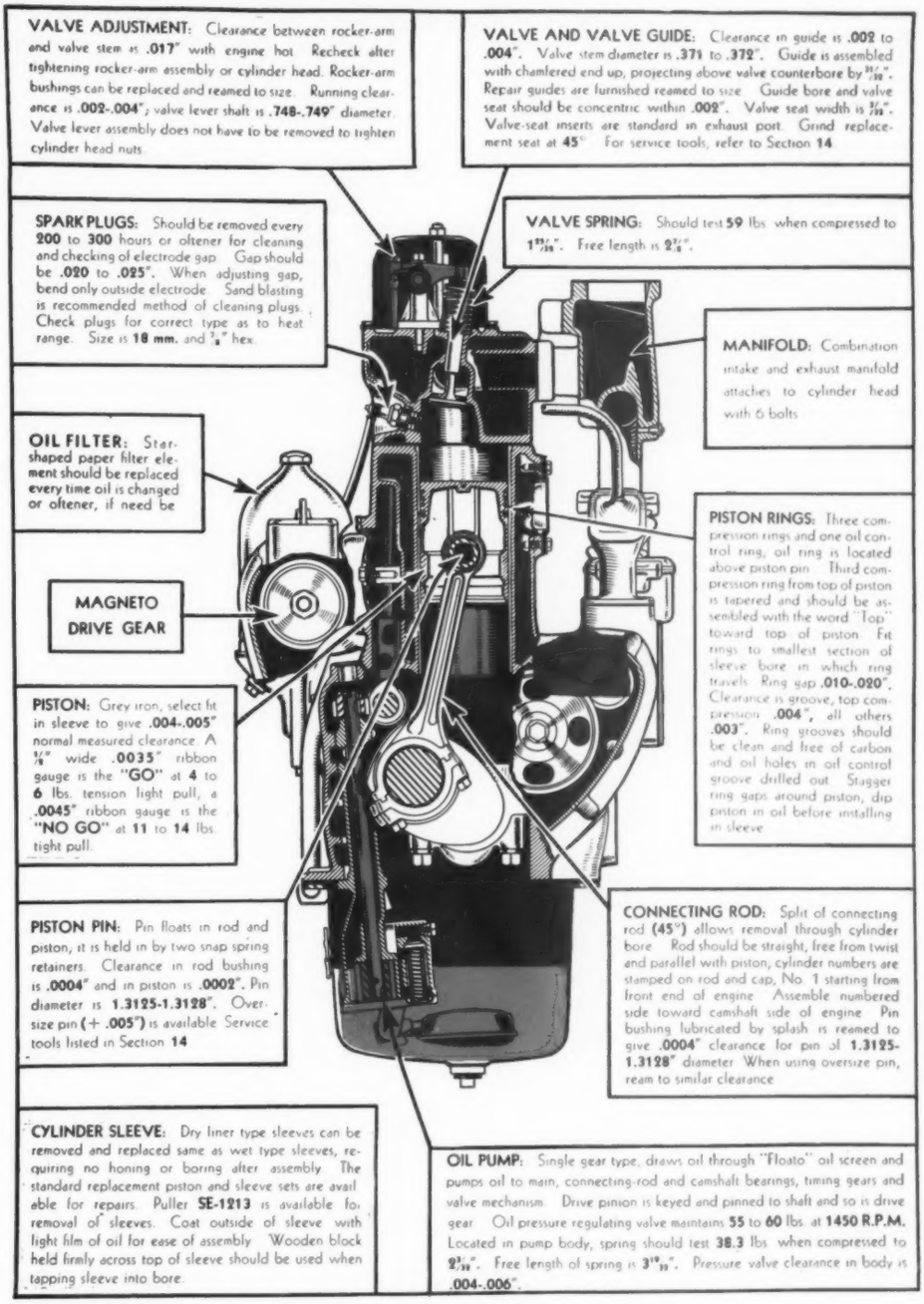
INTERNATIONAL Harvester's latest additions to its line of equipment are five new wheel tractors. The tractors are designated as the "I" line and include three models with carburetor-type engines and two with International's quick, easy starting, full-Diesel engines. All the five new tractors have Tocco-hardened crankshafts, pressure lubrication, replaceable cylinders, five forward speeds up to 15 miles per hour (except the I-6 and ID-6 which have five speeds up to 14

International Harvester's I-series wheel tractors.



miles per hour), gear drive, countershaft brakes that can be individually controlled or interlocked, provision for mounting a variety of allied equipment, and various other features. The three tractors with the carburetor-type engines are of the four-cylinder, valve-in-head type. The engine of the I-4 develops 29.5 hp. at rated governed speed of 1,450 r.p.m.; and that of the I-9, 54 hp. at rated governed speed of 1,450 r.p.m. The bore and stroke of the I-4 are 3⅜ by 4¼ in.; of the I-6, 3⅜ by 5¼ in.; of the I-9, 4.4 by 5.5 in. The two new Diesel-powered tractors not only use low-priced fuel but also use much less fuel than a conventional engine of the same size. It can be started as easily as a conventional engine of corresponding size. It starts as a gasoline engine and is quickly converted to full Diesel operation by means of a lever within easy reach of the driver. The engine of the Diesel ID-6 develops 38.5 hp. at rated governed speed of 1,450 r.p.m., and that of the Diesel ID-9 develops 51.5 hp. at rated governed speed of 1,500 r.p.m. The bore and stroke of the ID-6 are 3⅞ by 5¼ in. and the ID-9, 4.4 by 5.5 in.

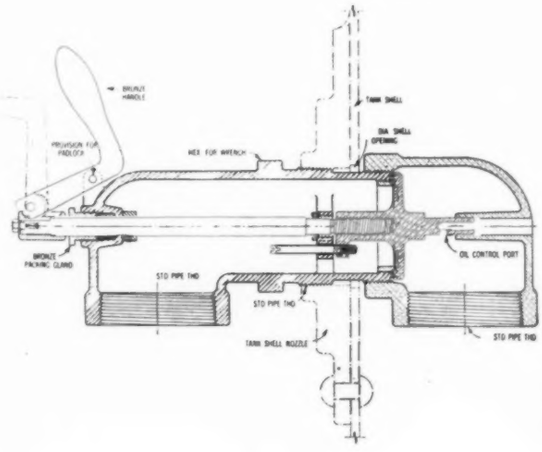
Engine of the I-series tractors developed by International Harvester Company.


VALVE ADJUSTMENT: Clearance between rocker-arm and valve stem is .017" with engine hot. Recheck after tightening rocker-arm assembly or cylinder head. Rocker-arm bushings can be replaced and reamed to size. Running clearance is .002-.004"; valve lever shaft is .748-.749" diameter. Valve lever assembly does not have to be removed to tighten cylinder head nuts.
VALVE AND VALVE GUIDE: Clearance in guide is .002 to .004". Valve stem diameter is .371 to .372". Guide is assembled with chamfered end up, projecting above valve counterbore by 31/32". Repair guides are furnished reamed to size. Guide bore and valve seat should be concentric within .002". Valve seat width is 3/32". Valve-seat inserts are standard in exhaust port. Grind replacement seat at 45°. For service tools, refer to Section 14.
SPARK PLUGS: Should be removed every 200 to 300 hours or oftener for cleaning and checking of electrode gap. Gap should be .020 to .025". When adjusting gap, bend only outside electrode. Sand blasting is recommended method of cleaning plugs. Check plugs for correct type as to heat range. Size is 18 mm. and 3/4" hex.
VALVE SPRING: Should test 59 lbs. when compressed to 1 13/16". Free length is 2 7/8".
MANIFOLD: Combination intake and exhaust manifold attaches to cylinder head with 6 bolts.
OIL FILTER: Star-shaped paper filter element should be replaced every time oil is changed or oftener, if need be.
MAGNETO DRIVE GEAR
PISTON RINGS: Three compression rings and one oil control ring, oil ring is located above piston pin. Third compression ring from top of piston is tapered and should be assembled with the word "Top" toward top of piston. Fit rings to smallest section of sleeve bore in which ring travels. Ring gap .010-.020". Clearance in groove, top compression .004", all others .003". Ring grooves should be clean and free of carbon and oil holes in oil control groove drilled out. Stagger ring gaps around piston, dip piston in oil before installing in sleeve.
PISTON: Grey iron, select fit in sleeve to give .004-.005" normal measured clearance. A 1/8" wide .0035" ribbon gauge is the "GO" at 4 to 6 lbs. tension light pull, a .0045" ribbon gauge is the "NO GO" at 11 to 14 lbs. tight pull.
CONNECTING ROD: Split of connecting rod (45°) allows removal through cylinder bore. Rod should be straight, free from twist and parallel with piston, cylinder numbers are stamped on rod and cap, No. 1 starting from front end of engine. Assemble numbered side toward camshaft side of engine. Pin bushing lubricated by splash is reamed to give .0004" clearance for pin of 1.3125-1.3128" diameter. When using oversize pin, ream to similar clearance.
PISTON PIN: Pin floats in rod and piston, it is held in by two snap spring retainers. Clearance in rod bushing is .0004" and in piston is .0002". Pin diameter is 1.3125-1.3128". Oversize pin (+ .005") is available. Service tools listed in Section 14.
CYLINDER SLEEVE: Dry liner type sleeves can be removed and replaced same as wet type sleeves, requiring no honing or boring after assembly. The standard replacement piston and sleeve sets are available for repairs. Puller SE-1213 is available for removal of sleeves. Coat outside of sleeve with light film of oil for ease of assembly. Wooden block held firmly across top of sleeve should be used when tapping sleeve into bore.
OIL PUMP: Single gear type, draws oil through "Floato" oil screen and pumps oil to main, connecting-rod and camshaft bearings, timing gears and valve mechanism. Drive pinion is keyed and pinned to shaft and so is drive gear. Oil pressure regulating valve maintains 55 to 60 lbs. at 1450 R.P.M. Located in pump body, spring should test 38.3 lbs. when compressed to 2 3/16". Free length of spring is 3 19/32". Pressure valve clearance in body is .004-.006".

◆

VAPOR RECOVERY COMPANY

THE purpose of a valve recently designed by The Vapor Recovery Systems Co. and illustrated below, is to furnish a water draw-off arrangement which will not freeze at the valve seat and which can be locked in either open or closed position. The anti-freeze feature is obtained by use of a sliding valve formed by a protrusion, cast on the inner valve, entering a cylinder on the inside of the inner elbow. This is called the oil control port. With the valve in open position the oil control port is closed. When water draw-off has been completed and valve is closed, the oil control port is open. This permits entry of oil into the elbow and displacement of water from the elbow and from around the valve seat. Inner valve does not rotate. One of the principle features of the valve is the locking arrangement. With the handle in vertical or operating position, a cam on the bottom of the handle firmly contacts a flat surface on the valve shaft. When the handle is moved to locking position, this cam disengages the valve shaft and the handle becomes free-wheeling so that it can always be brought into locking position regardless of the rotational position of the stem when the valve seats. Body of the valve is cast steel; valve pallet, valve seat ring, handle and inner elbow are bronze.



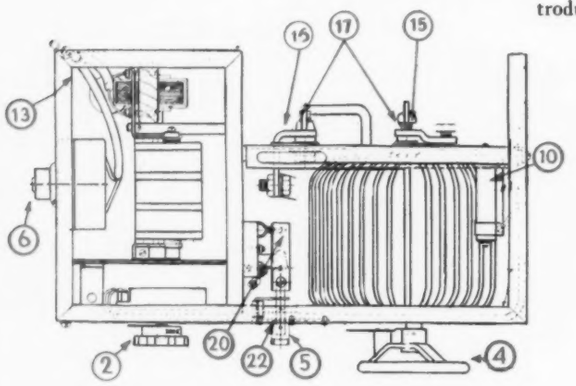
Vapor Recovery Company's water draw-off valve.

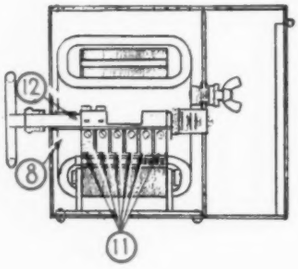
LINCOLN ELECTRIC CO.

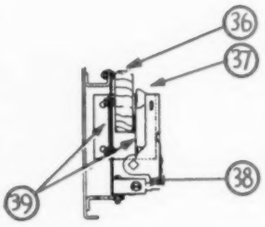
DEVICES and design improvements made by engineers of The Lincoln Electric Company, Cleveland, Ohio, during the past year provide greater protection for welding operators, prevent burn-outs of generators, eliminate the need for meters showing volts and amperes and permit maximum fuel economy and minimum engine wear in engine-driven arc welding machines.

Perhaps one of the most interesting developments from the standpoint of oilfield workers, is the elimination of the usual voltage and amperage meters. The new development is made possible as a result of the extreme accuracy in current adjustments available with "dual continuous control" in conjunction with Lincoln's self-indicating pre-set dials. Meters have been omitted from all machines produced by the concern, except those operating on direct current supply. An important advantage accompanying this design development is the ability to reverse polarity positively. This holds true even when the polarity reversing switch is thrown quickly. Other advantages are: the operator may set and read the current from the dial; trouble and expense from meter breakage is eliminated; and the polarity may be verified immediately by reference to the position of the switch handle.

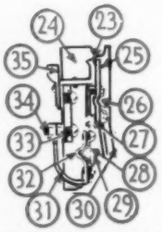
A new and improved arc welder control box introduced by the company prevents accidental contact with "live" electrical parts, increases accessibility, permits wiring with flexible or rigid conduit, or rubber-covered multiple-conductor cable, and eliminates dangers from unintentional loosening of the lifting hook. Both a.c. and d.c. compartments have a snap catch which holds the door in the closed position. The a.c. compartment door also has screws for locking to prevent any unauthorized person from opening the compartment and touching live parts. The catch, however, holds the door in closed position in case the screws should accidentally be left out of their proper places. On the d.c. compartment, the snap-catch feature of the door makes the terminals readily accessible without the use of tools and, at the same time, provides a complete cover for the terminals when the door is closed.



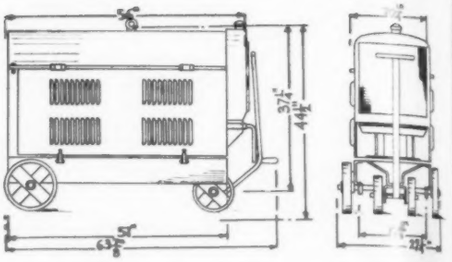




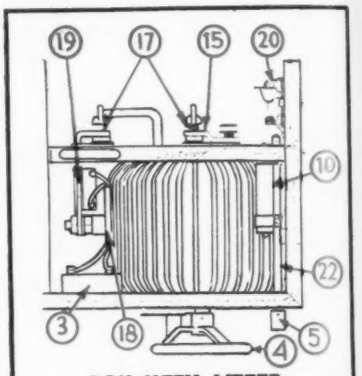
CONTACTOR PARTS



STARTER PARTS



Accompanying sketches show parts of Lincoln Electric's new control arrangement eliminating usual voltage and amperage meters from the engine driven arc welding machines such as the one illustrated directly above: note table identifying parts shown in the various sketches.



BOX WITH METER

WELDER (TYPE G) CONTROL PANEL

Ref. No.	Name or Description	Ref. No.	Name or Description
1	Control Cabinet Case	20	Polarity Reversing Switch
2	Rheostat Handle and Shaft	22	Shaft for Polarity Reversing Switch
3	Voltammeter	23	Stationary Contact
4	Current Control Handle	24	Barrier Assembly
5	Polarity Reversing Switch Handle	25	Moving Contact
6	Push Button	26	Contact Rivet
7	Polarity Reversing Switch Plate	27	Contact Spring
8	Current Control Shaft and Insulation	28	Shaft
9	Complete Current Control Assembly	29	Shaft Insulation
10	Resistor, Polarity Switch	30	Contact Arm
11	Brush Fingers & Coil Springs for Current Control	31	Contact Lead
12	Assembly of Current Control Brush Holder, Brush Fingers and Springs	32	Shaft Clamp
13	Control Harness-Push Button & Thermostat	33	Contact Block
14	Wing Nuts	34	Contact Block Cap Screw
15	Connection Strap -- Ground	35	Terminal Lug
16	Connection Strap -- Electrode	36	NVR Coil, Specify Voltage & Cycles Or give Marking on coil
17	Electrode Stud or Ground Stud	37	NVR Moving Lamination Assembly
18	Meter Harness	38	Interlock Assembly
19	Meter Shunt	39	Stationary Lamination Assembly

Fig. 4

Burn-outs because of heat or excessive currents are positively prevented by the new protective control device developed by the Lincoln Company. The protective control device consists of two current transformers, the primaries of which are connected in series with the motor leads. The secondaries supply power to operate two snap-action thermostats which are mounted directly on the motor lamination in such a way that they operate by means of heat conduction as well as by current passing through the thermostat. The thermostats automatically reset when the motor returns to a safe operating temperature. The new engine-driven welder perfected by the company's engineers, illustrated in the sketch at the top, right-hand side of this page, embodies a new system of engine-speed control for maximum fuel economy and minimum engine wear. This device known as the "job selector" directly varies the speed of the engine from 1800 to 1400 revolutions per minute for welding duty. In addition, this control may be used to bring the engine to an idling speed of about 900 revolutions per minute. At all times, the engine speed can be minimized to a rate actually required by the job at hand, thus keeping down fuel consumption and engine wear.

◆

Chain Belt Company

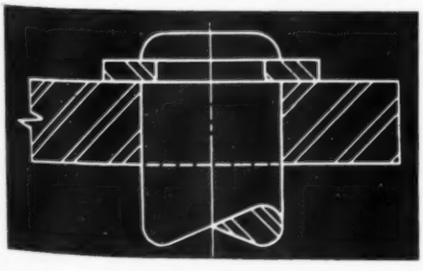
A NEW riveted type chain belt which avoids the possibility that cotter pins may work loose and shear off has recently been developed by the Chain Belt Co. An accompanying diagram shows a cross section of the new riveted head in the sidebar. The pin is riveted over a medium hard washer which can be sheared by sledging in much

Sample of the riveted type chain developed by Chain Belt Co. Note riveted head.

the same manner as cotters. The washer is sledged through; the pin is loosened by driving it the depth of a single sidebar; and the chain is easily taken apart. Because of this construction, the rivet head can be made small enough so that when driven out through the washer, it cannot score the sidebar hole or the inner surface of the bushing. The second illustration shows a two link sample of Rex Deepwell API 4, showing the new riveted design.

◆

Cross section of the riveted head in the side bar of the new chain designed by Chain Belt Co.



REED ROLLER BIT COMPANY

THE accompanying illustration shows the super shrink-grip tool joint developed by Reed Roller Bit Co. The particular advantages of this tool joint are detailed in the captions accompanying the illustration. Below is illustrated various steps in the operation of the Reed valve the design of which is basically that of the double disc gate valve. It should be noted particularly that a slight movement of the valve stem toward the open position lifts the disc directly away from its seat, partially equalizing the pressure on both sides of the downstream disc and reducing friction to a minimum. The valve is then moved to the open position with exceptional ease. The leading edges of the moving discs wipe the cylindrical bore of the body while the valve is being either opened or closed, cleaning the seats of all foreign matter and preventing packing them onto the seat faces. The bodies and bonnets are constructed with heavy wall sections to insure low unit stress under operating conditions. A male and female bonnet joint is provided and close tolerances assure interchangeability. Bonnet flanges are extra heavy to prevent distortion in service. The stuffing box design prohibits fluid leakage past the valve stem and insures a minimum of frictional resistance between the packing and stem. A two-piece ball joint gland prevents binding and equalizes the pressure applied to the packing by the gland. Various types of packing are available, and, as Reed valve stems are non-rising and rotate through only 90 degrees, the packing is unusually long-lived.

◆

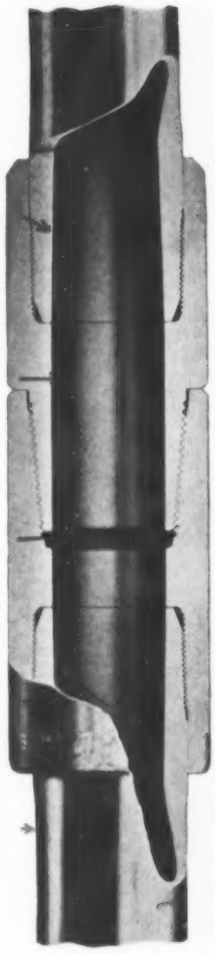
The long tool joint recess of the Reed Roller Bit Company's super shrink-grip tool joint is shrunk onto the drill pipe supporting the pipe against failure at the last engaged thread and sealing it against leakage.

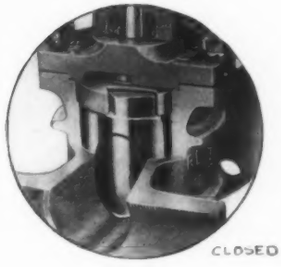
Gauging shoulder provides an added seal against leakage and failure.

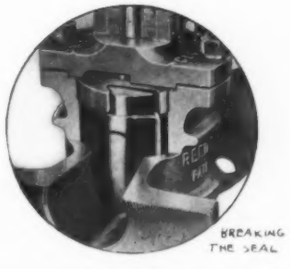
Accurate alignment between tool joint and pipe threads prevents excessive wear in box and pin threads.

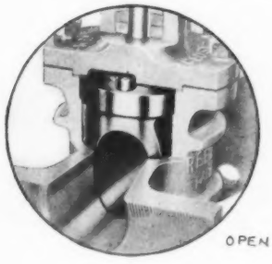
Threads with a wide flat crest and root, accurately machined form a dependable connection.

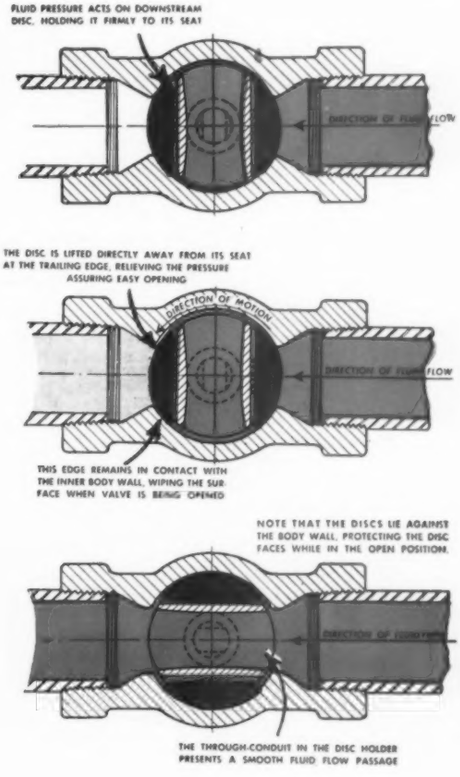
Square or tapered shoulders are optional and may be hard faced if required.



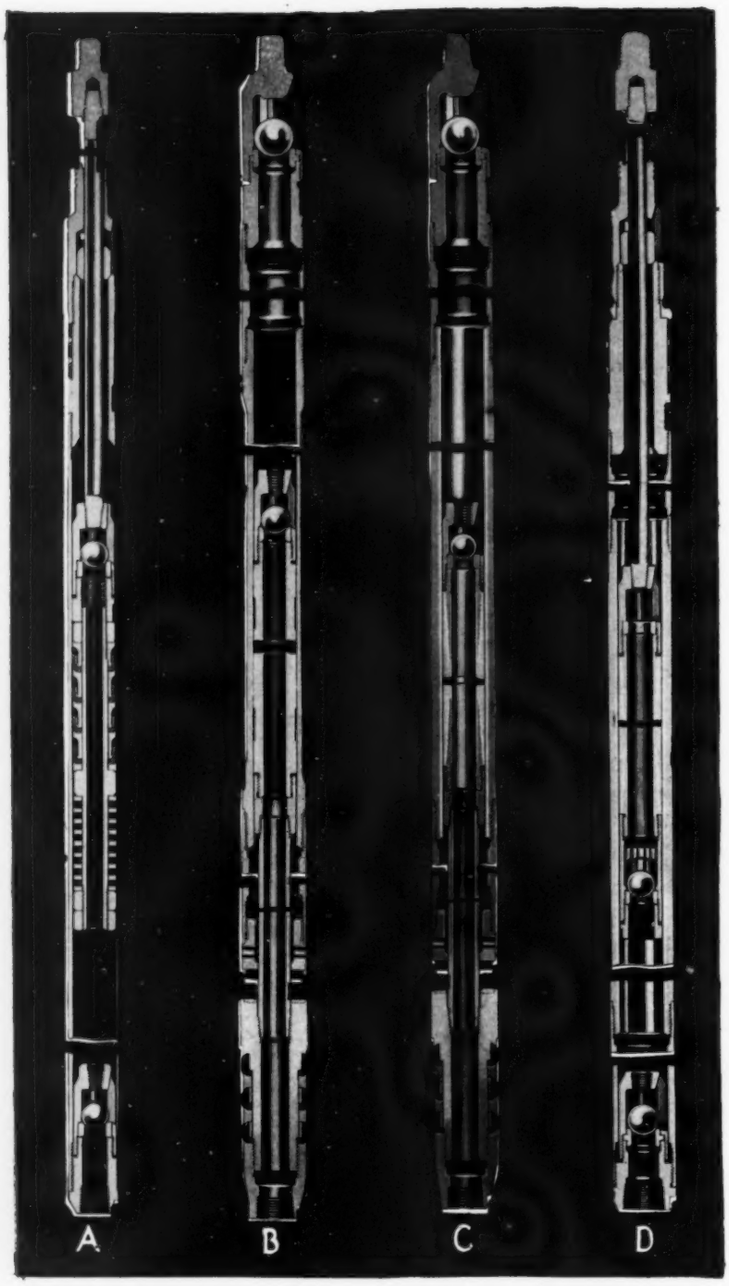







FLUID PRESSURE ACTS ON DOWNSTREAM DISC, HOLDING IT FIRMLY TO ITS SEAT
DIRECTION OF FLUID FLOW
THE DISC IS LIFTED DIRECTLY AWAY FROM ITS SEAT AT THE TRAILING EDGE, RELIEVING THE PRESSURE ASSURING EASY OPENING
DIRECTION OF MOTION
DIRECTION OF FLUID FLOW
THIS EDGE REMAINS IN CONTACT WITH THE INNER BODY WALL, WIPING THE SURFACE WHEN VALVE IS BEING OPENED
NOTE THAT THE DISCS LIE AGAINST THE BODY WALL, PROTECTING THE DISC FACES WHILE IN THE OPEN POSITION.
THE THROUGH-CONDUIT IN THE DISC HOLDER PRESENTS A SMOOTH FLUID FLOW PASSAGE

Operation of the Reed Roller Bit valve is shown at left.



Four types of Oil Well Supply Co. insert pumps.

Oil Well Supply Company

THE interchangeability of parts, which are made in accordance with A.P.I. specifications, is an outstanding feature of Oil Well Supply Company's line of insert pumps. This feature makes it possible to assemble pumps in a wide variety of sizes, types, barrel materials, and part combinations to suit operating conditions. The barrels or tubes of Oilwell insert pumps are furnished in Silverline (steel), Nickel-iron, precision-honed and resistant to many corrosive well fluids, and Di-hard, a lining of extreme hardness, bonded to the bore of the steel tube and honed to a mirror-finish.

All Oilwell insert pumps are supplied in both stationary-barrel and traveling-tube types, with plungers or cup, combination or repack valves; and with a wide selection of additional parts and accessories. Three simple assemblies are illustrated at the left. Fig. A: Silverline 2 in. by 1½ in. stationary-barrel insert pump with top seating, combination valve, and Fig. C standing valve. The sand check is a standard part of all Oilwell stationary-barrel insert pumps. Fig. B: Nickel-iron 2½ in. by 1½ in. traveling-tube insert pump with Type "H" bottom seating valve and steel plunger. Plungers are fully interchangeable between stationary-barrel and traveling-tube pumps and are made in a variety of materials. Fig. C: Di-hard 2½ in. by 1½ in. traveling-tube insert pump with Type "H" bottom seating valve and Di-hard plunger. Fig. D: Di-hard 2½ in. by 1½ in. stationary-barrel insert pump with top seating, Di-hard plunger with gas valve, and Fig. "C" standing valve. Stationary-barrel pumps can also be equipped for bottom seating.

CONSTANT and ample lubrication assures long and efficient service-life in the rotaries manufactured by Oil Well Supply Company. In the illustration at the bottom of this page the continuously circulating oilbath lubrication of the 27½-A Oilbath rotary is shown in solid red. The same lubrication system is also used in the 17½-inch Oilbath rotary, including separate lubrication of the pinion-shaft roller bearings in their sealed enclosures as indicated in shaded red in the same illustration.

Oil bath lubricated rotary developed by Oil Well Supply Co.

Oil picked up by the pinion and thrown from the gear is conducted by troughs in a steady stream to the main bearing. Part of the flow continues through the radial and hold-down bearing, keeping it constantly immersed in a shock-absorbing oil-cushion. Overlapping of the hold-down ring and oil-retainer ring insures complete return of the lubricant as it continues its circulating flow back to the resorvoir. Labyrinths at both the top and bottom effectively seal the oil bath.

The Oilwell 21-inch super-speed rotary is provided throughout with a forced-feed lubrication system which maintains a constant oil pressure at the extreme speeds (up to 1000 r.p.m.) for which this rotary is designed. The forced-feed lubrication is in addition to the splash system and is provided for the pinion-shaft roller bearings as well as the parts within the table enclosure.

In each rotary the fully heat-treated pinion shaft with its bearings, bearing housings, and locking wheel comprises a compact and sturdy unit-assembly. Skids, table enclosure, and cylindrical supports for the pinion-shaft bearing housings are integral parts of each rigid cast-steel base. The 17½-inch Oilbath rotary is designed for a 7,500-ft. drilling depth; 200-ton dead load; and 400 r.p.m. table speed. The 27½-A Oilbath rotary has a rated capacity of 17,000-ft. drilling depth; 300-ton dead load; and 400 r.p.m. table speed. The 21-inch super-speed rotary drills to 17,000-ft., carries a 300-ton dead load; and has a table speed of 1,000 r.p.m.

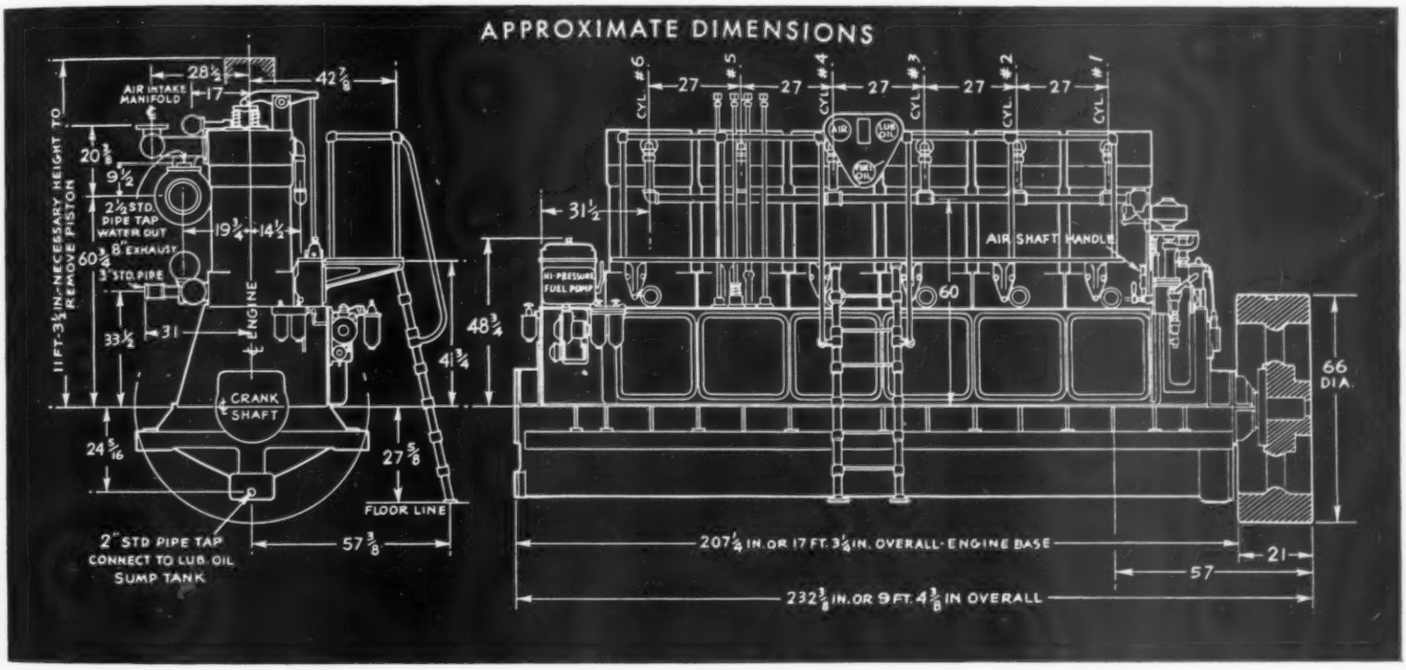
◆

Atlas Imperial

ATLAS Imperial Diesel Engine Company has developed a large capacity stationary engine, illustrated diagramatically below, suitable for continuous pipeline service. This is a four-cycle vertical engine with full Diesel mechanical injection. The model illustrated has six cylinders, 14½ in. bore by 18 in. stroke, a rated horsepower of 525 and a speed of 300 r.p.m. Individual cylinders have removable liners of chrome nickel alloy iron and are equipped with overhead valves. The engine is lubricated by a rotary centerframe. The high pressure fuel pump is made of nitralloy having three packless type plungers.

◆

Atlas Imperial Diesel Engine Company's stationary pipeline engine.



PRODUCTION ENGINEERS, INC.

THE PEI Well Purger developed by Production Engineers, Inc., is designed for use on wells which tend to die due to water or oil accumulating in the tubing, and on wells that the operator desires to flow on small chokes in controlling gas-oil ratio, where additional production at intervals is necessary, to obtain allowable, or to prevent killing the well. The purger is manufactured in two sizes, the low pressure model is designed for operating pressures of 300 lbs. or less, the high pressure model for operating above 300 lbs. The terms "high pressure" and "low pressure" refer only to the size spring used, as each purger is subjected to 3,000 lbs. test. The PEI Well Purger illustrated on the right is a pressure-controlled valve and is installed in a by-pass around the regular production choke on the christmas tree, an additional choke being placed in the by-pass, downstream from the purger. When the tubing pressure drops to any point selected, due to the well loading up with water or dead oil, the purger valve opens, allowing the well to produce through its regular choke and the additional choke in the by-pass. This increased rate of flow produces the accumulated water or dead oil from the tubing, which allows the tubing pressure to build back up. At the time the tubing pressure has increased to approximately 10 percent above the pressure at which the purger valve was set to open, the purger valve closes, restoring flow through the regular choke.

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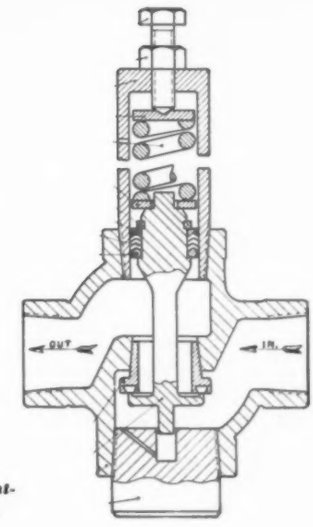
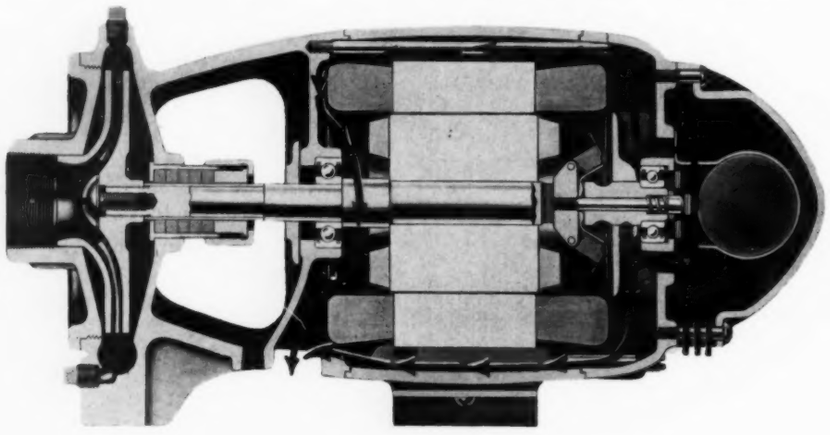


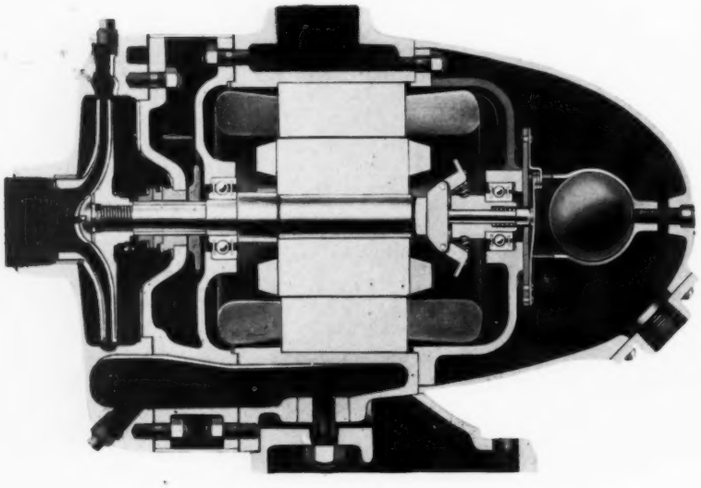
Production Engineers recently developed well purger.

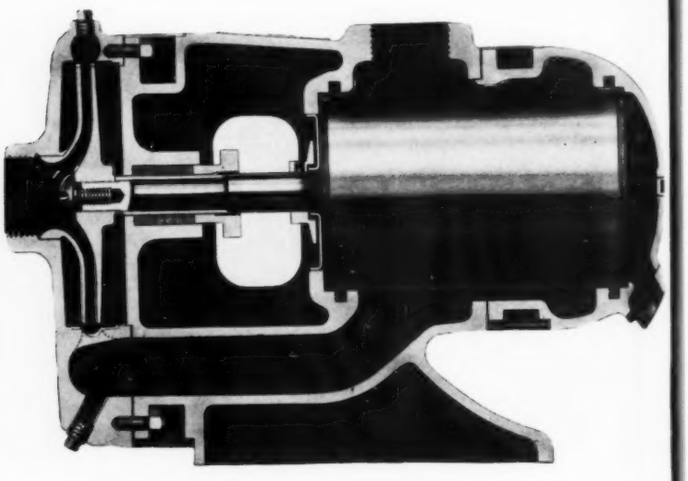
A. O. Smith Corp.

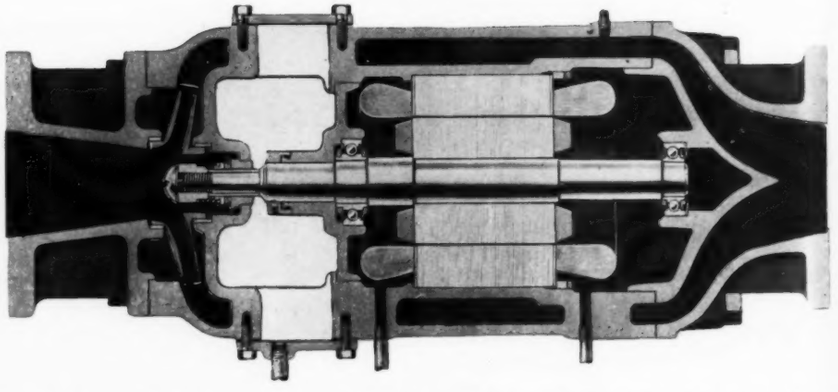
ILLUSTRATED on this page are four A. O. Smith Corporation pumps including the very recently developed pipeline pump, which is bolted directly into the line requiring no foundation and being cooled by the liquid to be pumped which passes all around the motor. In each of the four Smithway pumps illustrated the cooling medium is indicated in blue. First the Smithway liquid cooled centrifugal pump with ½ to 10 hp. 3-phase built in motor is arranged as a continuous cooling agent. The main frame with discharge connection built into the top, has a rigid base permitting mounting of the pump in any desired position or as part of a larger unit.

Four Smithway pumps: just below the ½ to 1½ h.p. single phase air cooled; center left, the ½ to 3 h.p. single phase liquid cooled; center right, the ½ to 10 h.p. three-phase liquid cooled; and at bottom, the new 3 to 25 h.p. liquid cooled three phase that can be built directly into a pipeline.









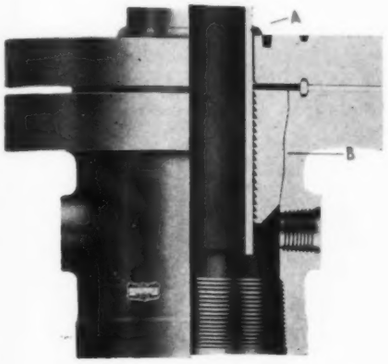
The second of these four new pumps is also a liquid cooled centrifugal equipped with ½ to 3 hp. single phase built in motor which is an efficient capacitor-type motor, specially designed for pumping service. Instead of commutators and brushes, this motor has a unique centrifugal switch for the capacitor circuit, used only when starting. When running, there is no contact of electrical parts of any kind. Sawyer hi-power motors have the smallest size-to-power and the highest power-to-weight ratios of any standard motors. Smithway single-phase pumps are built to operate on current of 110-220 volts and 60 or 50 cycles, as ordered. Designed for the best hydraulic efficiency, this pumping unit makes full use of the developed motor power. Passageways and vanes are properly streamlined. The enclosed type impeller is regularly made of bronze, while the volute is made of close-grain iron.

The third Smithway illustrated is an air-cooled centrifugal pump with ½ to 1½ single phase motor built in. Permanent alignment is assured by rigid construction. A locking device prevents the loosening of the impeller from the motor shaft and a shaft seal is used instead of the customary stuffing box, thereby eliminating the need for repacking and adjustment. Sealed ball bearings of ample size support the single shaft to which both rotor and impeller are attached; lubricant is sealed in for the lifetime of the unit. All couplings are eliminated, the rotor-impeller assembly being the only moving part and this is dynamically balanced at running speed for smooth vibration-free operation.

Finally the fourth and most recently developed Smithway pumping unit has a liquid cooled 3 to 25 hp. 3-phase built in motor operating a centrifugal pump. It combines a fully enclosed motor with a highly efficient pump in a single frame assembly, arranged to utilize the liquid being pumped as the cooling medium for the motor. With both ends flanged the entire unit bolts right into the pipeline permitting straight-through flow. Thus the pump becomes an integral part of the line, eliminating the need for foundations and base plate mounting. This pump is built for pumping liquids up to heads of 180 ft. at temperatures up to 200 deg. F. or higher.

ATLAS ENGINEERING WORKS

THE Atlas Type A-3 combination casing and tubing head illustrated on this page consists of two Atlas Type S-W slip suspension casing heads, and a Type A-3 tubing head, with permanent slip suspension of the oilstring in the well. The view is reproduced on this page. The Type A-3-L tubing head illustrated is also a full opening head of high strength steel and the all-metal seal ring, same as the Type A-3 tubing head. An additional feature of this head is the locking ring and screws which permits locking the hanger securely within the head. Atlas reversible hydraulic pull-press illustrated is designed for pulling and replacing pump liners, removing and replacing valves; removing gears and clutches and straightening kellys and small bars. The Atlas boiler feed water heater is equipped with settling trays and a filter, to stop practically all scaling troubles, by removing foreign matter from water that acts as a bonding agent. Scale and sediment settling to the bottom of the tanks is blown off through a drain valve.

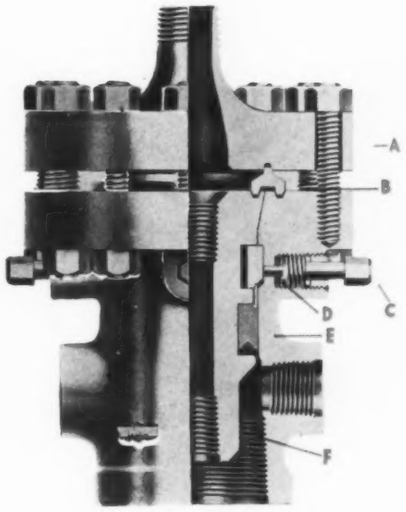


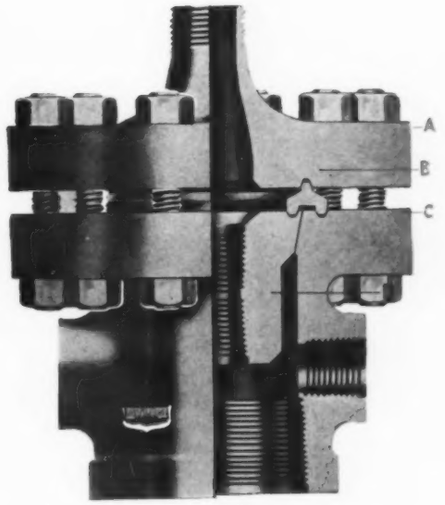
Atlas type S-W casing head, (A) shows welded bead attaching casing to flange and (B) the double tapered slips.

Type S-W casing head is a full opening casing head for high pressures, and permanent slips are used for suspension of the oil string in the well. (See cross section view on this page.) The Type A-3 tubing head is a full opening head having the safe, all-metal seal ring as a seal between tubing, oil string and atmosphere. A cross section

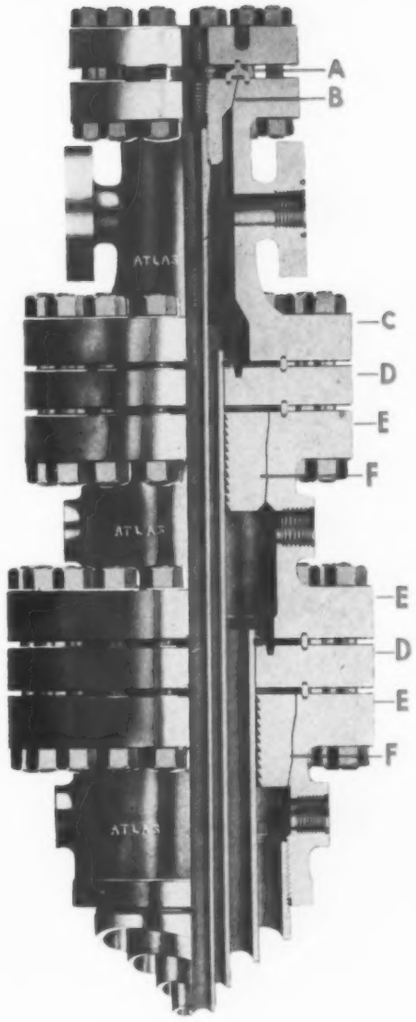
The reversible hydraulic tool: (A) is hydraulic unit; (B) control valve; (C) one piece yoke; (D) expanding slips.

Atlas Type A-3-L tubing head: (A) bonnet, threaded male end; (B) all-metal seal ring; (C) releasing screws; (D) collapsible ring; (E) V-shaped oil resistant packing ring; (F) hanger.

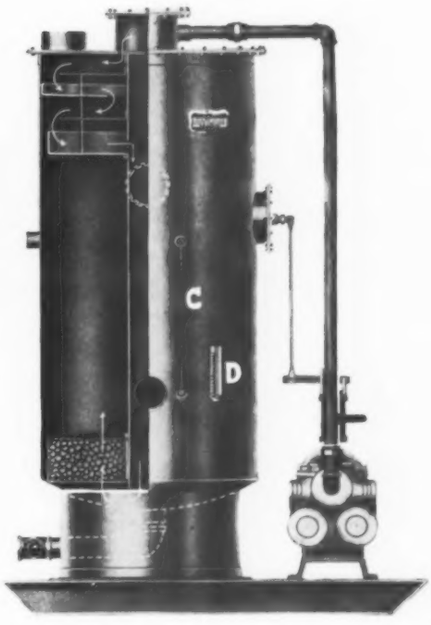




Type A-3 tubing head: (A) bonnet; (B) all-metal seal ring; (C) body of tubing head; (D) hanger.



Above, Slip suspension casing head: (A) seal ring; (B) hanger; (C) body; (DD) welded flanges; (EEE) bodies of casing heads; (FF) double tapered slips. Below, automatic boiler feed water heater.



CATERPILLAR TRACTOR COMPANY

CATERPILLAR Diesel engines, Model D 17000 of which is illustrated below, have recently been improved by the addition of front and rear supports and may be installed with or without steel channel bases. Instrument panels have been mounted on brackets and may be turned around at will or located wherever needed. Starting cranks have been relocated on the side eliminating the necessity of the operator walking to the front of the engine. In the accompanying front and side views oil is shown in red; water in blue.

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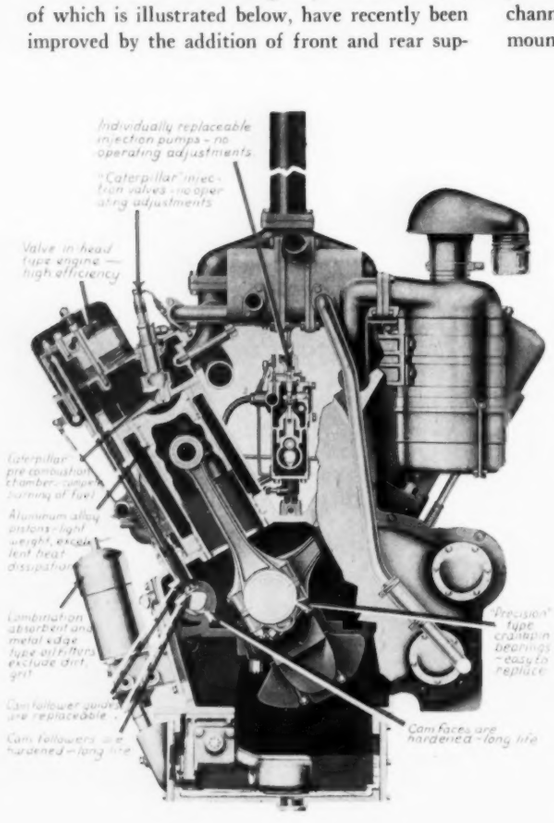
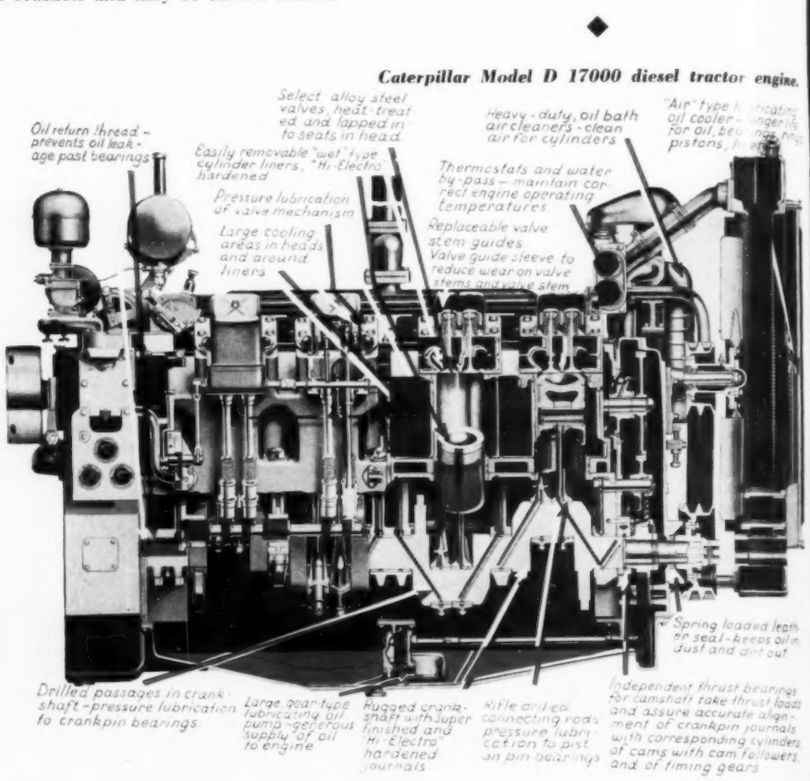

Individually replaceable injection pumps – no operating adjustments
"Caterpillar" injection valves – no operating adjustments
Valve in head type engine – high efficiency
Caterpillar precombustion chamber – complete burning of fuel
Aluminum alloy pistons – light weight, excellent heat dissipation
Combination absorbent and metal edge type oil filters exclude dirt
Cam follower guides are replaceable
Cam followers are hardened – long life
"Precision" type crankpin bearings – easy to replace
Cam faces are hardened – long life

Caterpillar Model D 17000 diesel tractor engine.

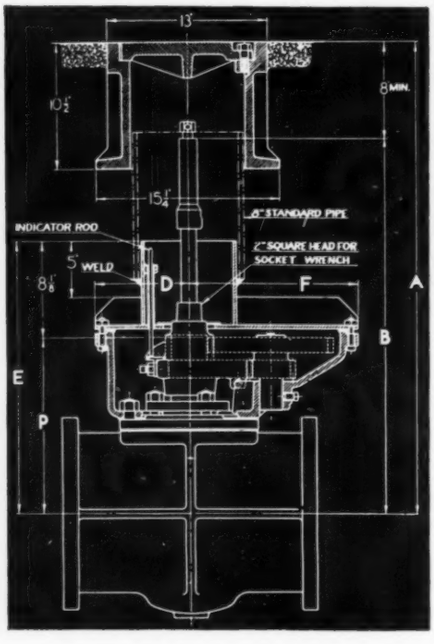

Oil return thread – prevents oil leakage past bearings
Select alloy steel valves, heat-treated and lapped in to seats in head
Easily removable "wet" type cylinder liners, "Hi-Electro" hardened
Pressure lubrication of valve mechanism
Large cooling areas in heads and around liners
Heavy-duty, oil bath air cleaners – clean air for cylinders
"Air" type lubricating oil cooler – longer life for oil, bearings, pistons, liners
Thermostats and water by-pass – maintain correct engine operating temperatures
Replaceable valve stem guides. Valve guide sleeve to reduce wear on valve stems and valve stem
Spring loaded leather seal – keeps oil in, dust and dirt out
Drilled passages in crankshaft – pressure lubrication to crankpin bearings
Large gear-type lubricating oil pump – generous supply of oil to engine
Rugged crankshaft with super finished and "Hi-Electro" hardened journals
Rifle drilled connecting rods – pressure lubrication to piston pin bearings
Independent thrust bearings for camshaft take thrust loads and assure accurate alignment of crankpin journals with corresponding cylinders, of cams with cam followers, and of timing gears

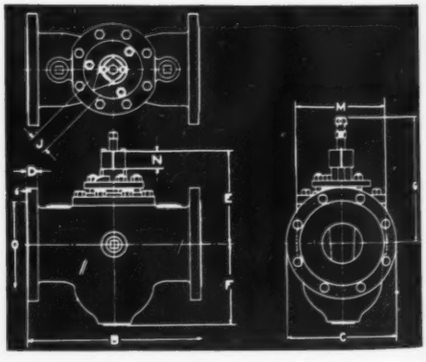
MERCO NORDSTROM VALVE COMPANY

FOR installation where the line contents must be maintained at a predetermined temperature by external heating, several types of steam jacketed valves have been developed by Merco Nordstrom Valve Company, one of which is illustrated herewith. They are made of semi-steel and are cast with a double walled body, providing a heat space completely surrounding the plug seat and outlet throats. To accommodate the double wall and allow bolt clearance, the end flanges have the dimension of a standard pipe flange one or more sizes larger than the nominal size of valve. Thus, connection to piping may be made by use of standard reducing flanges. These valves are 150-lbs. and 250-lbs. line working pressures. The jackets are designed for saturated steam pressures up to 150 lbs. Tapped bosses are provided at the top, bottom and sides of the jacket for making connections for steam supply and drainage of condensate. These valves are available in sizes from one to six inches, wrench operated.

WHERE it is desired to install spur geared plug valves underground without providing a vault, a new type of water tight gear housing has been developed by Merco Nordstrom Valve Company as shown in the accompanying illustration.

Right, Merco Nordstrom steam jacketed valve and below, the water tight gear housing.

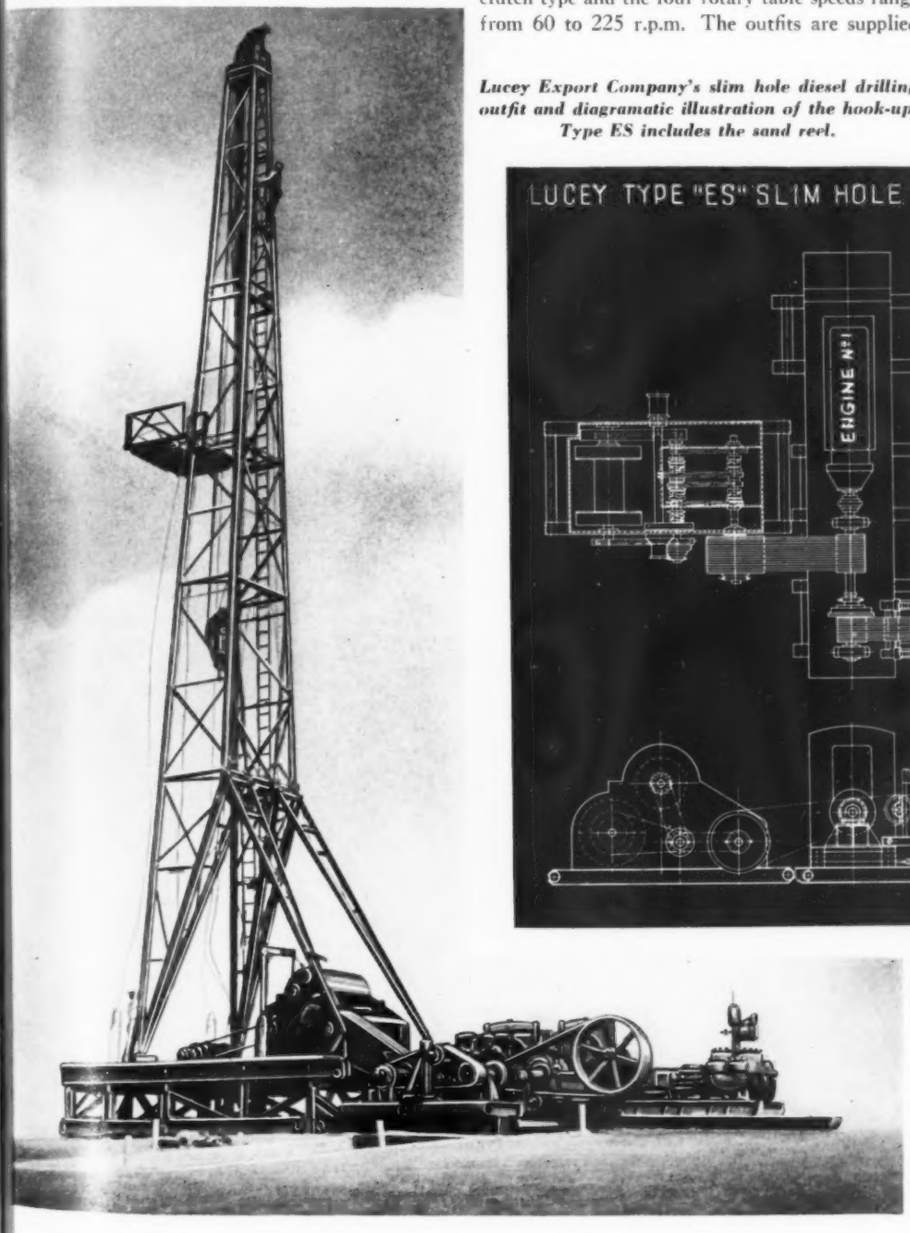


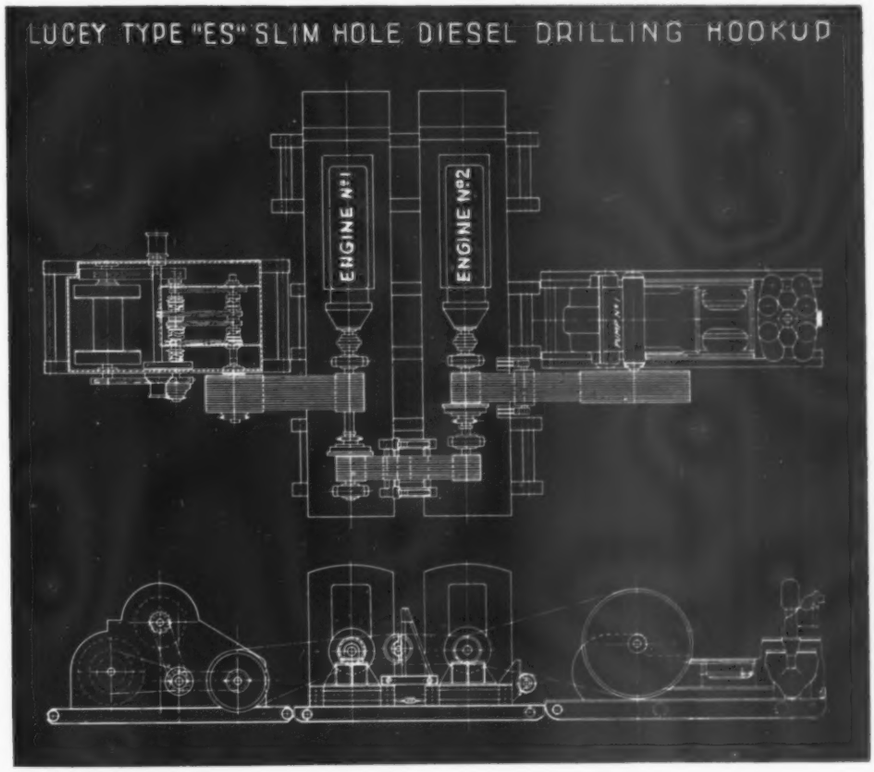


It is a combination of gear housing and road box. The installation is connected in the field by a section of eight inch standard steel pipe, cut to length required by the depth of the valve below the surface. The standard housings have gasket joints and steel connections to the standpipe, thereby excluding ground water and silt from the space around the gearings.

LUCEY EXPORT CORPORATION

LUCEY slim hole Diesel drilling outfits are built in four sizes and capacities for drilling to the following depths with a liberal factor of safety: Type "B", 2,000 ft. to 3,000 ft.; Type "C", 3,000 ft. to 4,000 ft.; Type "D", 4,000 ft. to 5,000 ft.; Type "E", 5,000 ft. to 7,000 ft. When a sand reel is built in as part of the drawworks unit, an "S" is added to the above letters. All of these outfits are identical in general design. The outfits for shallower drilling are lighter in construction, have fewer Texropes, smaller drums, bearings and other dimensions. Engines of smaller horsepower are used and the slush pumps are smaller. Each outfit consists of the drawworks unit, two engines and a pump—all mounted on sled-type skids. Two pumps may be supplied if desired. The type "ES" (with sand reel) outfit illustrated herewith has the following features: Power is supplied by two full Diesel engines of 200 hp., 800 r.p.m. for continuous operation. They are started by air from an independent gasoline-driven air compressor with a main tank and an auxiliary tank. These tanks also supply air for operating the air controls when the outfit is so arranged. Texropes are used to connect the engines, drawworks and pump. Overhanging sprockets allow easy removal of the Texropes. All sprockets and shafts are of alloy steel, hardened and ground. The sprocket chain, with the exception of the rotary drive, is double roller chain in oil-tight cases with spray lubrication. An oil reservoir is built into base of the unit and the oil is filtered before returning to the reservoir. The lubricating pump is driven by chain from the jackshaft. The rotary drive is of the friction clutch type and the four rotary table speeds range from 60 to 225 r.p.m. The outfits are supplied with necessary belt idlers and screw jacks as regular equipment and may be supplied with guards for the Texropes and sled-type sub-bases for supporting the engine skids, if so ordered.





Lucey Export Company's slim hole diesel drilling outfit and diagramatic illustration of the hook-up. Type ES includes the sand reel.

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GASO PUMP COMPANY

THE Gaso Pump and Burner Manufacturing Company of Tulsa, specialists in the manufacture of pipe line pumps, have continued during the year to perfect the construction of their line of pumps. Among the features of Gaso pumps are the enclosed crankcase, with gears, crossheads and connecting rod bearings lubricated by oil bath and the herringbone gears, assuring quiet and efficient performance. The crankshaft and pinion shaft are mounted in Timken tapered roller bearings, while Hyatt roller bearings are used on the pinion shaft. The pumps are equipped with hi-tensile alloy heat-treated stud bolts on fluid end and have hardened and ground steel valves and seats. Interchangeable liners permit a wide range of capacities and pressures. The alloy-iron piston bodies are grooved for cast-iron piston ring packing. The pumps are easily adapted to any liquid by means of special fittings. Gaso pumps can be arranged for any type of drive: Pulley for flat belt; electric motor through silent chain, "V" belts, or reduction gears; and "V" belts to multiple cylinder engine.

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THE COOPER-BESSEMER CORPORATION

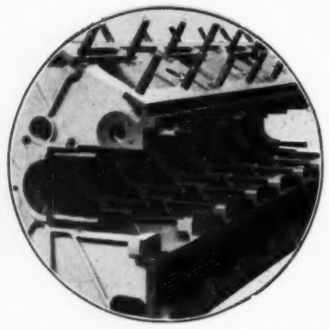


Fig. 1

AMONG the many design and engineering features of the Cooper-Bessemer Type GMV gas engine driven compressor, four stand out as being especially worthy of description. As may be seen in the cross-section diagram, this compressor unit is a combination of "V" engine and horizontal compressor cylinders, with power cylinders arranged in a vertical "V", and compressor cylinders placed horizontally. The units are built in 4, 6, 8 and 10 cylinder sizes, and are rated 400 to 1000 hp. They are of the 2-cycle trunk-piston type.

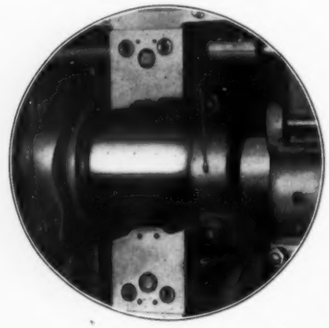
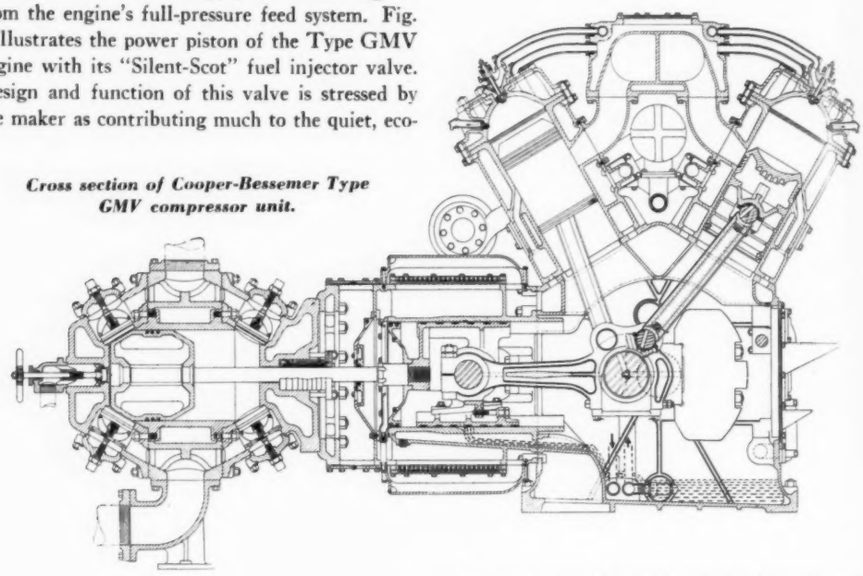


Fig. 2

First among the four features mentioned above is the open-jaw construction of the engine base. This construction is clearly illustrated in Fig. 1. This arrangement makes for an especially rugged engine frame, and the illustration shows how the entire crankshaft may be removed from the side of the engine with ease. Heavy steel studs hold the power cylinders in place. Similar studs hold main bearing caps securely in place, and permit quick and easy removal of main bearings from the shaft. All of these main bearings are precision type, and interchangeable with no hand fitting or scraping necessary. Upon removal and replacement of any main bearing the engine can be immediately started and brought up to full load, full speed without danger—a distinct advantage of the precision type bearing manufacture. The heavy sections of the engine base are clearly apparent, and these make for a strong and rugged main frame for the engine. This main frame is cast entirely of Meehanite metal for the manufacture and use of which the maker is a licensee. Fig. 2 illustrates the main and crankpin bearing assembly as used in the Type GMV compressor. Crankpin bearings are also precision type and completely interchangeable. Here again open-jaw construction of the engine base permits unusual accessibility to the crankshaft, and heavy steel studs assure the bearings being fitted and held firmly in place. These babbitt-lined, steel-shell bearings receive their supply of lubricating oil from the engine's full-pressure feed system. Fig. 3 illustrates the power piston of the Type GMV engine with its "Silent-Scot" fuel injector valve. Design and function of this valve is stressed by the maker as contributing much to the quiet, economical performance of these gas engine driven units. The injector valve has a unique ported construction which vents the gas fuel directly toward the spark plug and into the flow of combustion air, to provide an economical and instantly combustible fuel mixture which fires under any load conditions. By simply turning the valve head with a wrench, the size of the port opening may be increased or decreased to adjust gas flow for its Btu content, or to balance closely the load among the engine cylinders. Clearances between valve stems and tappets are never changed through this arrangement. Thus, silent operation and the very minimum of wear on valve stems and tappets is assured. Fig. 4 illustrates the oil cooled piston as used in the Type GMV compressor unit. Lubricating oil is brought up through the drilled connecting rods to a fully enclosed chamber beneath the piston crown. There it circulates and performs its cooling task, then flowing down through the connecting rod to the lubricating oil sump. This system of oil cooling is not to be confused with others which employ merely a spray of oil against the under side of the piston crown. Benefits from this oil cooling are numerous and important. Naturally, lower operating temperatures are achieved. Closer piston-to-cylinder clearances are possible, with reduced blow-by and increased efficiency. Sticking of piston rings is greatly retarded.



Cross section of Cooper-Bessemer Type GMV compressor unit.

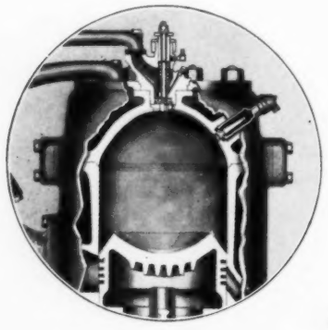


Fig. 3

Fig. 4

Pressure lubrication is provided to all main, crankpin, piston pin, crosshead, and auxiliary drive shaft bearings. The lube oil pressure pump is built into the base of the engine and chain driven from the crankshaft. Leads from this pressure system supply oil to governor, auxiliary drive mechanism, and all moving parts within the engine. A pressure regulating valve maintains definite oil pressure at all points, and a spring loaded check valve in the end of the system keeps the oil lines filled when the engine is not in operation. The power and compressor cylinders are lubricated by two, separate, force-feed, mechanical lubricators which also serve the compressor rod bearings, making possible the use of different grades of lubricants.

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LEEDS AND NORTHRUP COMPANY

FOUR PIECES of equipment of special interest to the oil industry, developed by Leeds and Northrup, are illustrated on this page: The SO_2 gas analysis equipment; the dehydrator-water pH; the Micromax pneumatic control; and, the self balancing indicator. The gas analysis equipment illustrated on the right measures SO_2 directly, and, when a deviation from desired strength begins to appear, it opens or closes the air valve by an amount which is proportional to the deviation.

The dehydrator-water pH illustrated in the center of this page consists of a sensitive detecting electrode, a reference electrode and a recorder housed in a metal flow chamber. Into this chamber pours a continuous sample of waste water, fed from the draw-off line just beyond the separator as shown in the diagram. This sample constantly flows over the parts of the assembly which are sensitive to pH, and then discharges to a sewer outlet. As the sample passes through the flow chamber, the electrodes, which are connected to the recorder, continuously set up a voltage proportional to pH . . . actuating the recorder very much as a thermocouple actuates a Micromax temperature recorder.

Diagram of Leeds and Northrup SO_2 gas analysis equipment.

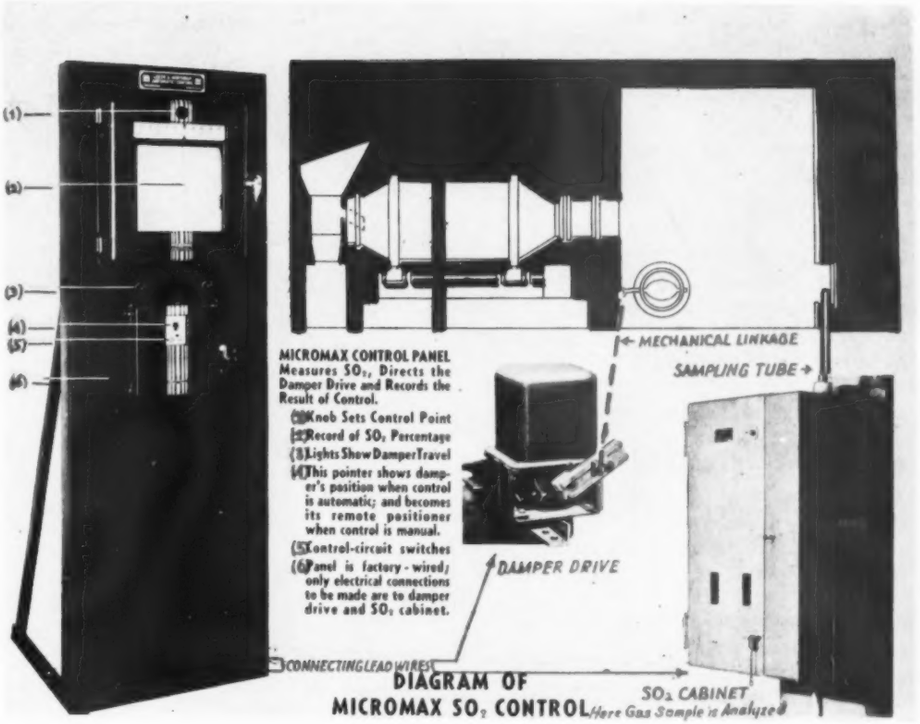
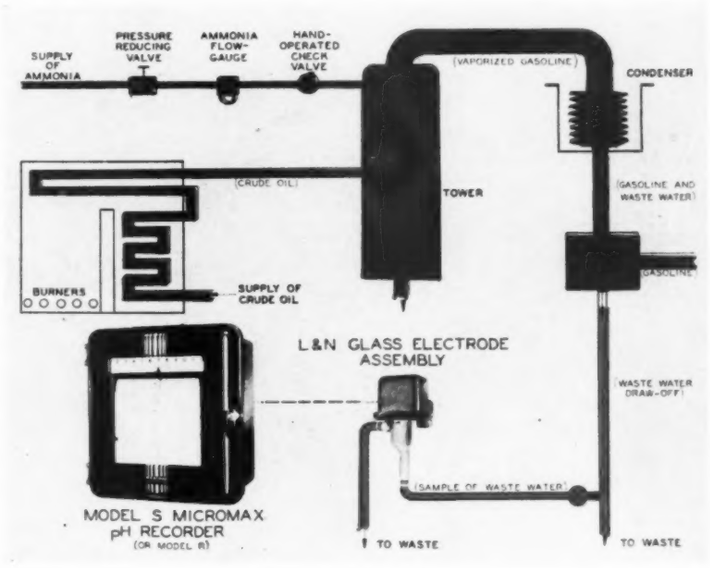

MICROMAX CONTROL PANEL
Measures SO_2, Directs the Damper Drive and Records the Result of Control.
(1) Knob Sets Control Point
(2) Record of SO_2 Percentage
(3) Lights Show Damper Travel
(4) This pointer shows damper's position when control is automatic; and becomes its remote positioner when control is manual.
(5) Control-circuit switches
(6) Panel is factory-wired; only electrical connections to be made are to damper drive and SO_2 cabinet.
MECHANICAL LINKAGE
SAMPLING TUBE
DAMPER DRIVE
CONNECTING LEAD WIRES
SO_2 CABINET
Here Gas Sample is Analyzed

DIAGRAM OF MICROMAX SO_2 CONTROL



Right, Leeds and Northrup dehydrator-water pH: Below, diagram of the Micromax pneumatic control device.

The Micromax pneumatic control, the action of which is illustrated at the bottom of this page, employs two balances; an electrical balance for measurement and a pneumatic balance for control. The control consists of action which is a direct function of temperature and action which is a function of both how far and how long temperature is off the control point.

The Micromax self balancing indicator measures the temperatures of a large number of thermocouples in any desired order.

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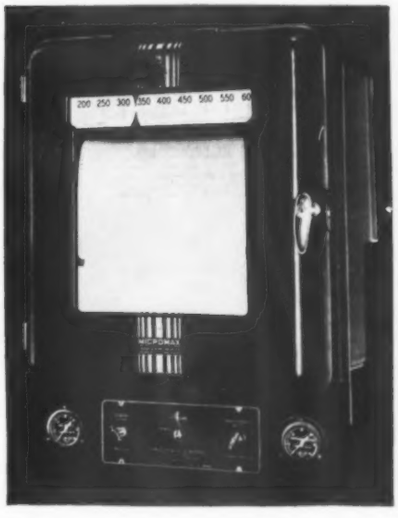
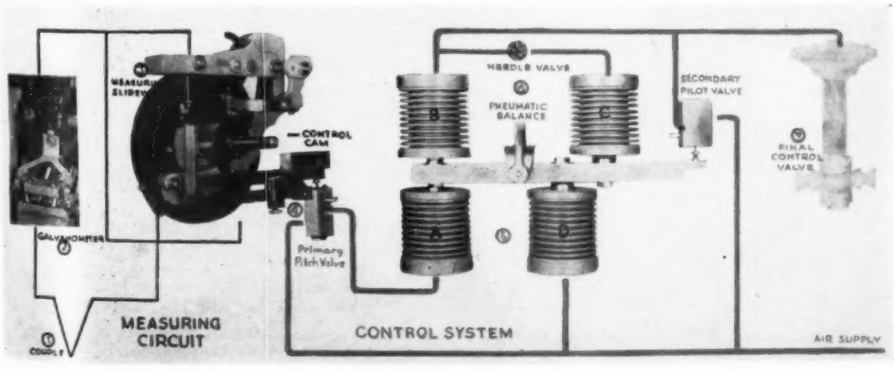
Leeds and Northrup self balancing temperature indicator.





Taylor Instrument Company

THE aneroid manometer, a brand new development of the Taylor Instrument Company, from definition, is a pressure or differential pressure measuring device using no liquid. This means specifically that it is a manometer employing no mercury or other liquid as the force or pressure balancing medium in the manometer. Standard ranges are 0 to 20, 50, 100, and 200 inches of water. On special order 300, 400, and 500 inches of water ranges can be supplied. Provided that the range interval starts at 0, the instrument can be conveniently calibrated to intermediate ranges between 20 in. and 400 in. water without recourse to special construction and by using standard range torque tubes. Two body assemblies are available which classify the meter as to working pressure. These are as follows: Cold working pressure, 1500 lbs. per sq. in. or, 300 lbs. per sq. in., cold test pressure, 2500 lbs. per sq. in. or, 500 lbs. per sq. in.

In the accompanying diagrams on this page and the top of the facing page Fig. 1 shows the installation of the aneroid manometer on a rate-of-flow application. The relation of the piping set, orifice connections and the pen arm linkage to the manometer are illustrated. In Fig. 3 the high pressure is connected to (10) or (18) and this pressure is exerted on the outside of the bellows (4). The low pressure connection is made at (2) or (26) and this pressure is connected to the inside of the bellows. As the differential pressure increases, the free end of the bellows moves to the left. Referring to Fig. 4, yoke (20) is connected to the bellows. The yoke is connected to the lever (14) through a flexible strip (19). The upper end of lever (14) clamps to the inboard end (32) of the torque tube (35). As previously mentioned, bracket (9) clamps to surface (33) of the torque tube housing. The flexible strips (11) connect bracket (9) to lever (14), and this is the means of support for the free end of the bellows and lever (14) and its associated parts. The bellows movement is therefore transferred through yoke (20), strip (19), and lever (14) directly to the free end (32) of the torque tube. A rotary movement is thus imported to this end of the torque tube. Fig. 5 is a cross-section of the torque tube. The outer section (37) is held rigidly to the manometer housing by threads (36). The inner section (35) is welded at its outboard end (38) to the outer or housing section. The inboard end is free, and to it is welded the shaft (34) which passes through section (35), cap (39), and into the case where the linkage is connected. The rotary motion developed by lever (14) therefore twists the tube section (35) and shaft (34) rotates with the end (32). This construction provides a packless, greaseless, friction-free assembly for transmitting the bellows motion to the outside of the manometer housing.

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ANEROID FLOWMETER
TYPICAL INSTALLATION AND OPERATION

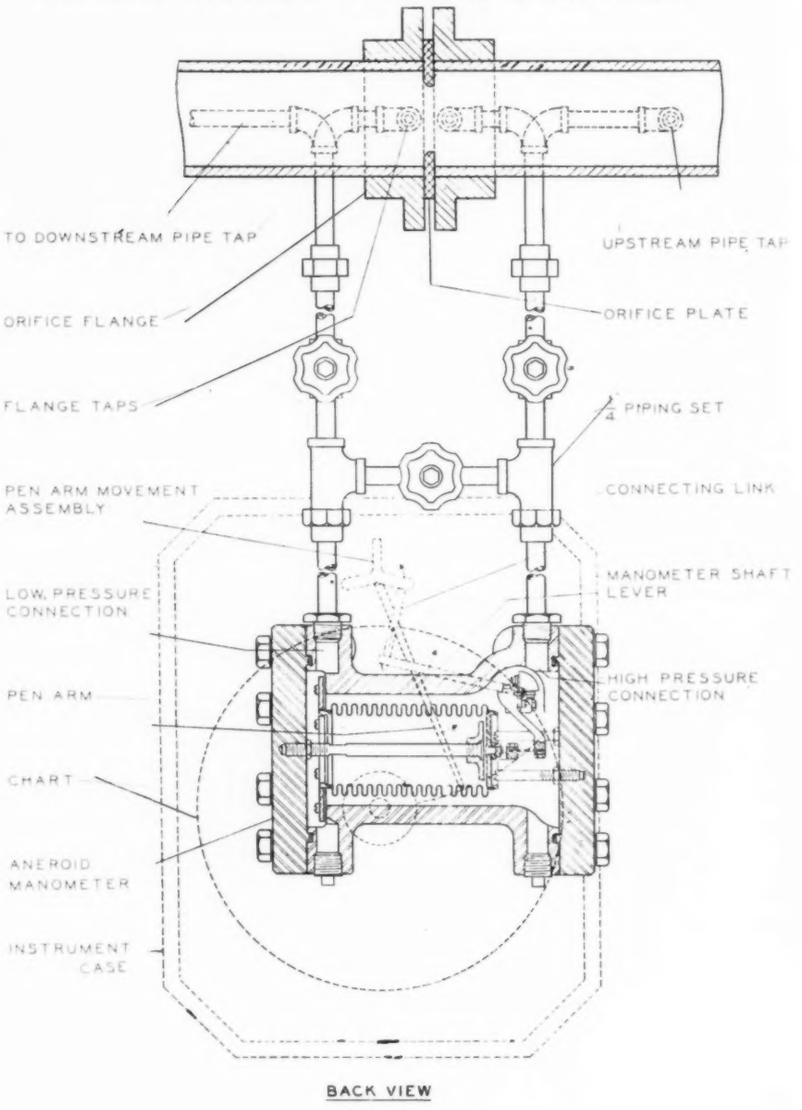


Figure 1

Figure 2

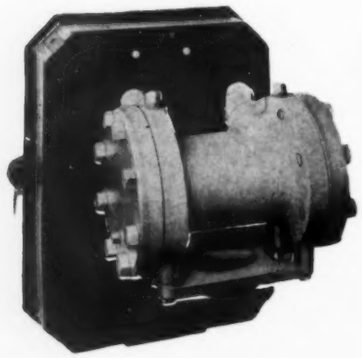


Figure 3

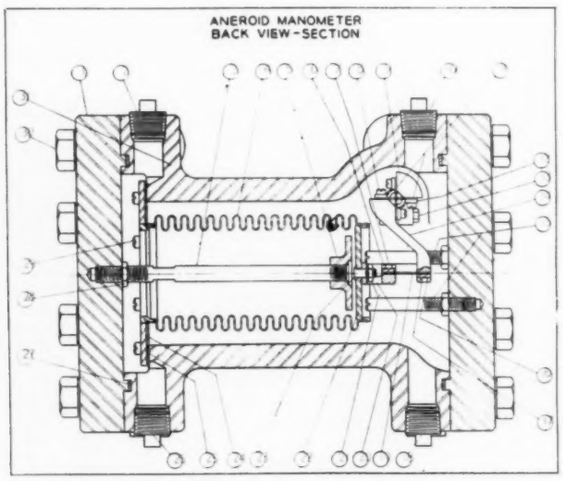


Figure 4

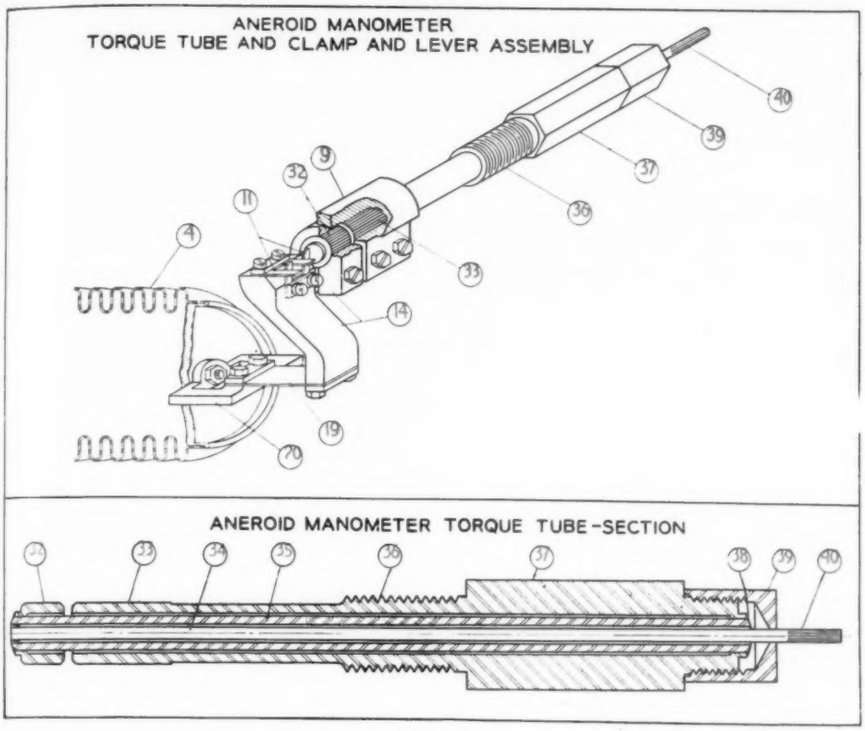
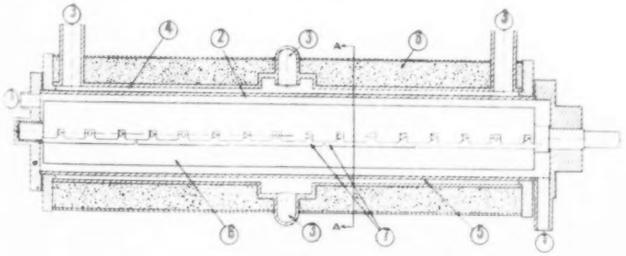
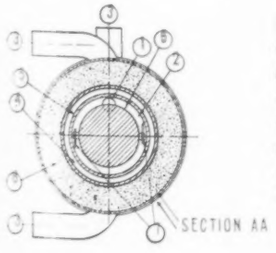


Figure 5

The Girdler Corp.

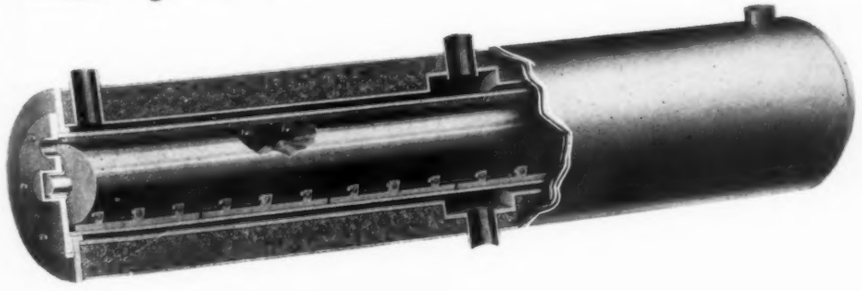
A HIGHLY EFFICIENT, continuous, closed type of heat transfer mechanism for liquids and viscous materials known as the Votator has been developed by The Girdler Corporation. The unique basic features of the Votator are—continuous operation under pressure in a closed system, and extremely rapid rate of heat transfer. The latter feature results from the high ratio of heat transfer surface to volume of material. These patented principles, are illustrated in the accompanying drawings. One illustration shows a cut-away view of the entire unit. The diagrammatic drawings show both horizontal and end cross-sections. The sections of the Votator indicated by the numbers are as follows: (1) Product connections. (2) Annular space through which product passes. (3) Heat transfer medium connections. (4) Annular space through which heat transfer medium passes. (5) Heat transfer tube. (6) Mutator shaft. (7) Scraper blades. (8) Insulation.





(1) PRODUCT CONNECTIONS
(2) PRODUCT CHAMBER
(3) HEAT TRANSFER MEDIUM CONNECTIONS
(4) HEAT TRANSFER MEDIUM CHAMBER
(5) HEAT TRANSFER TUBE
(6) MUTATOR SHAFT
(7) SCRAPER BLADES
(8) INSULATION

Girdler Corporation's continuous closed type of heat transfer: the arrangement for the connections for the product and for the medium permit varied piping hook-ups so that the mechanism can be incorporated into virtually any flow system. Multiple assemblies may be used for both heating and cooling the product in a few seconds.



Larkin Packer Company

LARKIN PACKER COMPANY has introduced the geyser principle of fluid action as an improvement in side-opening guide shoes and float shoes as a result of a long period of research and development to prove the value of this feature in guiding, floating, and cementing equipment. The geyser design represents an improved side opening that delivers approximately 60 percent of the fluid at a 30-deg. downward angle through the side outlet. This jetting action of slurry is evenly distributed around the entire circumference of the shoe and the motion thus provided has been found to clean thoroughly the wall of the hole at the point of jet impingement, the manufacturer states. By slowly raising and lowering the casing prior to and during the cementing operation the user is able to clean the well bore of mud cake, and thus assure a better cement job, it is pointed out.

The manufacturers supply geyser guide shoes and geyser float shoes having an upward motion of slurry rather than the downward motion when the upward motion is preferred. The geyser design is such that not only does the method of baffling the ports in this shoe reduce to a minimum the possibility of an uneven distribution of slurry due to clogged side-ports, but even if a port should become clogged the action of fluid passing through the other ports would quickly wash-out obstructing matter, it is stated. The knife-like jetting action provided by the geyser type shoes not only is recommended by the makers for washing down restricted or bridged holes, but for cutting away and circulating from the hole the mud cake always present on the face of the porous producing formations.

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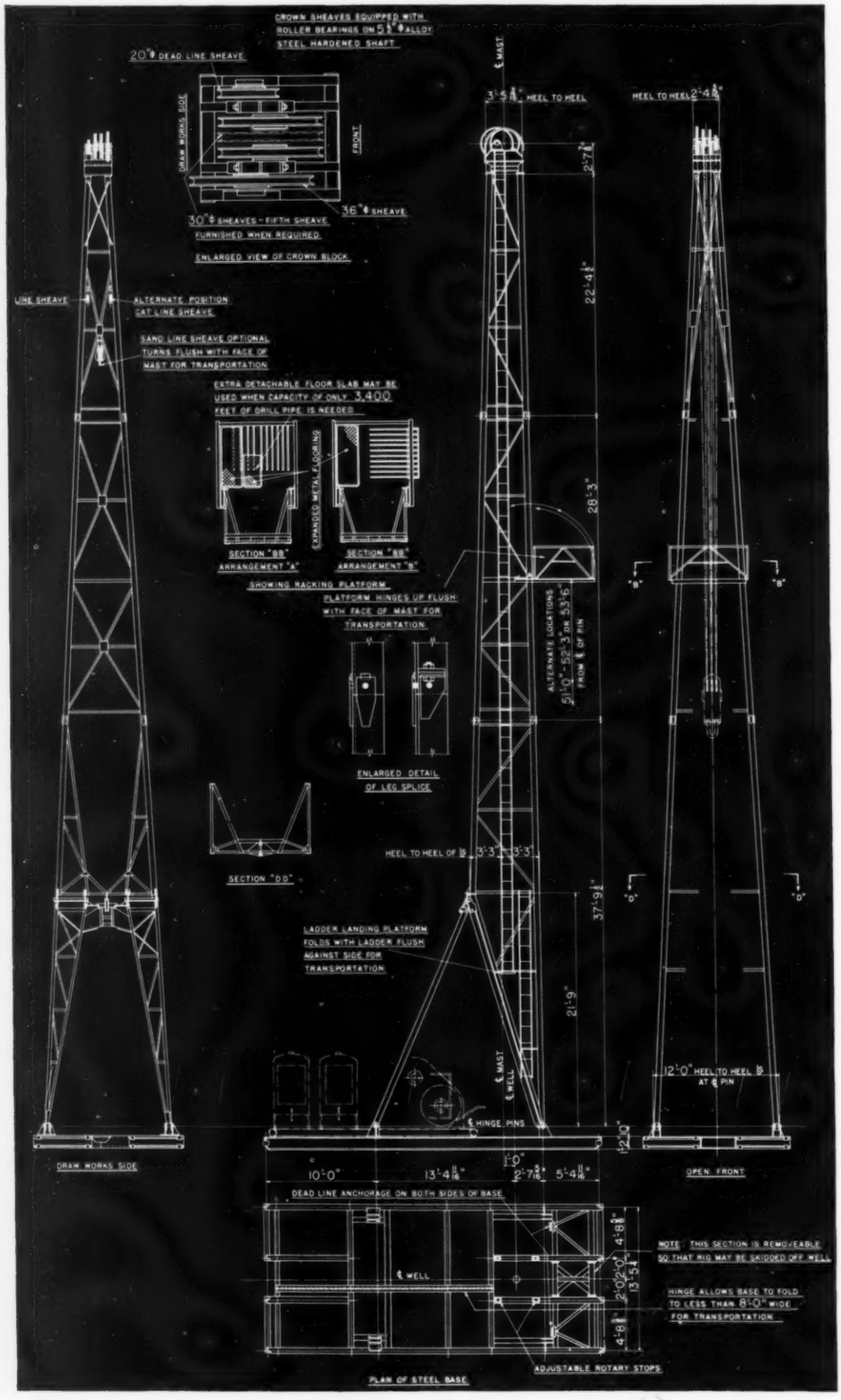
Left the Larkin geyser guide shoe, and right, the Larkin geyser float shoe.

LEE C. MOORE COMPANY

THE Lee C. Moore Company has responded to the growing demand from the petroleum industry for increased portability in derrick design by the design and construction of a full size portable mast adequate for the heaviest drilling duty. The mast is illustrated diagrammatically on this and the facing page, both erected for drilling and horizontal for transport. The mast is available in sizes up to 126 ft. Two important steps in the evolution of this mast were: First, the dimensions were cut down to the minimum consistent with efficient operation. This was done by means of the open front design in which the drill pipe is stacked outside the derrick rather than inside. Second, by the use of arc welded sectional construction the weight was cut to a minimum without loss of strength and rigidity. This last feature precluded conventional methods of erection. The mast was, therefore, designed to be assembled in the horizontal position along the ground and then raised up into the erect position. In order to eliminate introduction of mechanical equipment for this purpose the mast was so designed that the drawworks line and drilling tackle could be used for erection. An erection gin pole, folded against the bottom section for transportation, is erected with the aid of a gin truck used for handling the various sections of the mast. This gin pole subsequently becomes part of the derrick proper. The drilling line is strung from the hoist drum over a sheave in the top of the erection gin pole, through the crown block and traveling block and dead ended to a built-in anchor the same as for drilling. This proves somewhat less laborious and certainly less hazardous than when done in the erect position. A sling or bridle line is secured to the top of the erection gin pole and to the drilling hook. By pulling on the drawworks line the mast is then pulled into an upright position, two bolts are secured and the mast is ready for drilling. To lower the mast this procedure is reversed. The entire time of assembling and erecting the mast has proved to be but a small part of the rigging up work necessary at each location. On short moves the mast is frequently not disassembled but moved complete with lines strung, from one location to the next. This is facilitated by the rigid steel base furnished with all these masts. For highway moves the mast is broken down into sections small enough to be handled by trucks and within legal limit as to size and weight.


CROWN SHEAVES EQUIPPED WITH ROLLER BEARINGS ON 5⅜" ALLOY STEEL HARDENED SHAFT
20" ø DEAD LINE SHEAVE
DRAW WORKS SIDE
FRONT
36" ø SHEAVE
30" ø SHEAVES - FIFTH SHEAVE FURNISHED WHEN REQUIRED
ENLARGED VIEW OF CROWN BLOCK
LINE SHEAVE
ALTERNATE POSITION CAT LINE SHEAVE
SAND LINE SHEAVE OPTIONAL TURNS FLUSH WITH FACE OF MAST FOR TRANSPORTATION
EXTRA DETACHABLE FLOOR SLAB MAY BE USED WHEN CAPACITY OF ONLY 3,400 FEET OF DRILL PIPE IS NEEDED
EXPANDED METAL FLOORING
SECTION "BB" ARRANGEMENT "A"
SECTION "BB" ARRANGEMENT "B"
SHOWING RACKING PLATFORM
PLATFORM HINGES UP FLUSH WITH FACE OF MAST FOR TRANSPORTATION
ENLARGED DETAIL OF LEG SPLICE
SECTION "DD"
HEEL TO HEEL OF ⅋
LADDER LANDING PLATFORM FOLDS WITH LADDER FLUSH AGAINST SIDE FOR TRANSPORTATION
℄ MAST
℄ WELL
℄ HINGE PINS
DRAW WORKS SIDE
OPEN FRONT
DEAD LINE ANCHORAGE ON BOTH SIDES OF BASE
℄ WELL
NOTE: THIS SECTION IS REMOVEABLE SO THAT RIG MAY BE SKIDDED OFF WELL
HINGE ALLOWS BASE TO FOLD TO LESS THAN 8'-0" WIDE FOR TRANSPORTATION
ADJUSTABLE NOTARY STOPS
PLAN OF STEEL BASE
HEEL TO HEEL
ALTERNATE LOCATIONS FROM ℄ OF PIN

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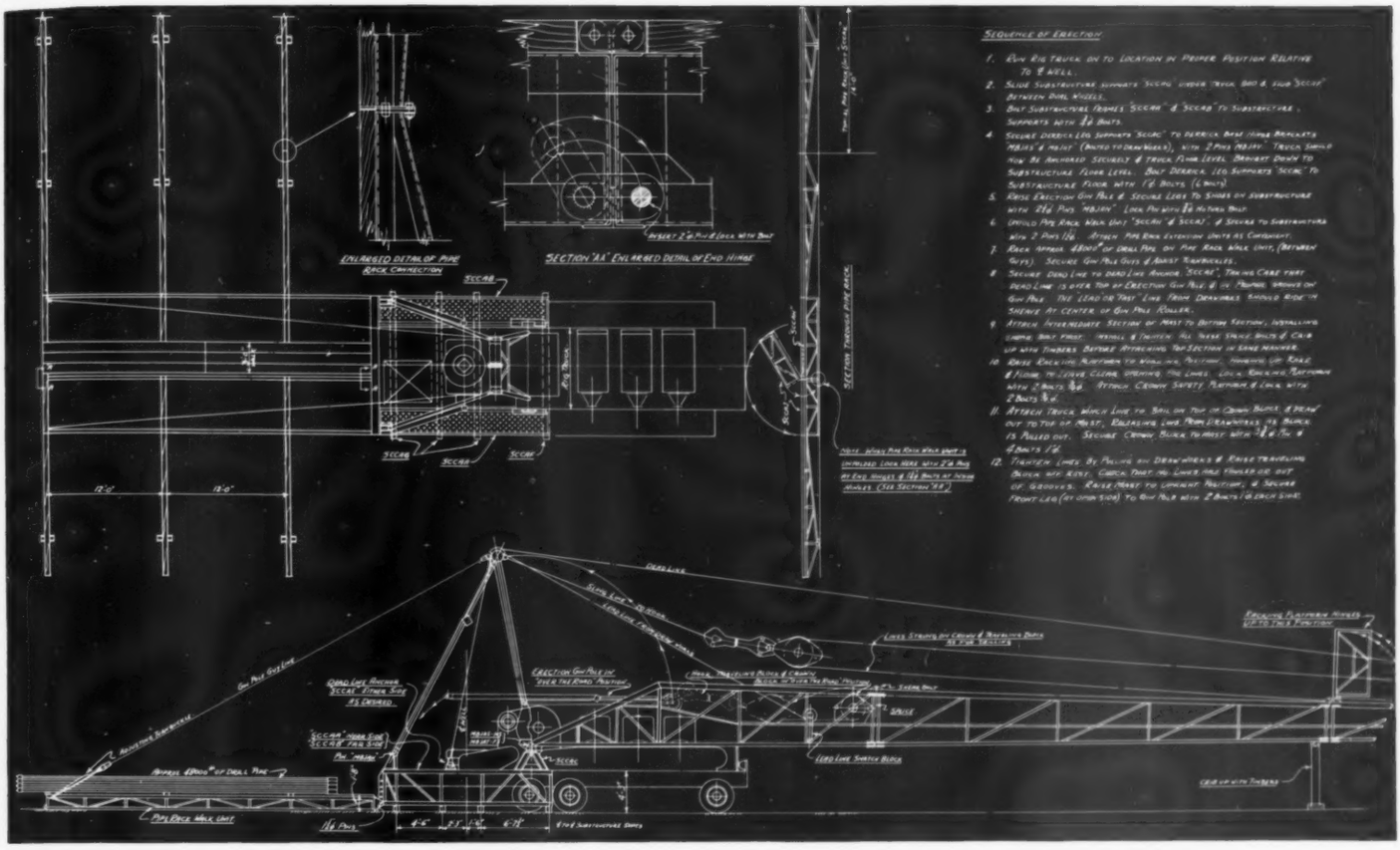
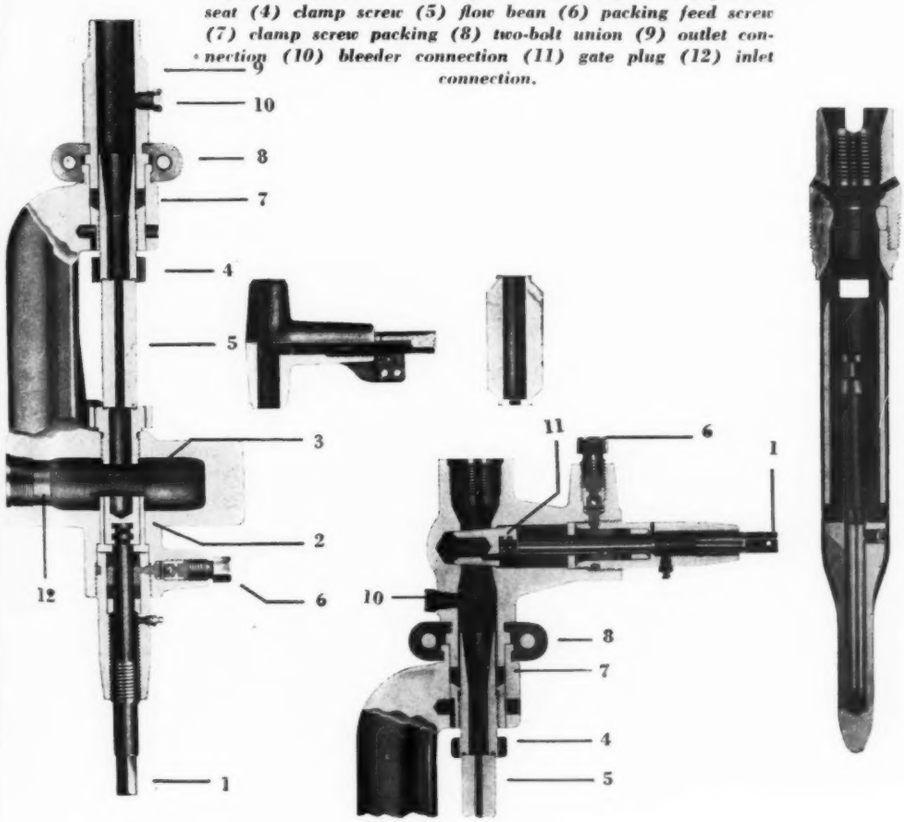
Plans of Lee C. Moore portable full size mast—derricks up to 126 ft. Left, the mast erected for drilling; facing page, mast mounted on truck for transport.


SEQUENCE OF ERECTION
ENLARGED DETAIL OF PIPE RACK CONNECTION
SECTION "AA" ENLARGED DETAIL OF END HINGE
SECTION THROUGH PIPE RACK

CAMERON IRON WORKS

Left, Cameron flow wing: (1) valve stem (2) valve seat (4) clamp screw (5) flow bean (6) packing feed screw (7) clamp screw packing (8) two-bolt union (9) outlet connection (10) bleeder connection (11) gate plug (12) inlet connection.



THE Cameron type D flow wing illustrated at the far left below combines in a single unit the double function of a Christmas tree wing valve and a quick change positive flow bean. Referring to the illustration, when it is desired to change a flow bean the hexagon socket in the wrench is fitted to the valve stem (1) and the valve (2) closed against the seat (3). The spanner part of the wrench is then applied to the clamp screw, (4), which must be turned only two turns to release the flow bean (5). After installing a new flow bean of the desired orifice size, it is clamped in place by the clamp screw. The valve is then opened and the well is back on production. Both the valve stem and valve seat are faced with hard metal to resist cutting. The valve stem and bonnet are packed with plastic packing which may be replenished under pressure. The clamp screw is packed with an asbestos ring (7) which is tightened automatically as the flow bean is clamped in place. The Cameron Type B velocity valve on the right of the accompanying group of diagrams is designed to shut in the well automatically should any of the surface fittings fail. It consists of (1) the retainer nut; (2) valve seat; (3) tubing hanger; (4) valve cage; (5) drop; (6) set screw; and (7) the adjusting pin.

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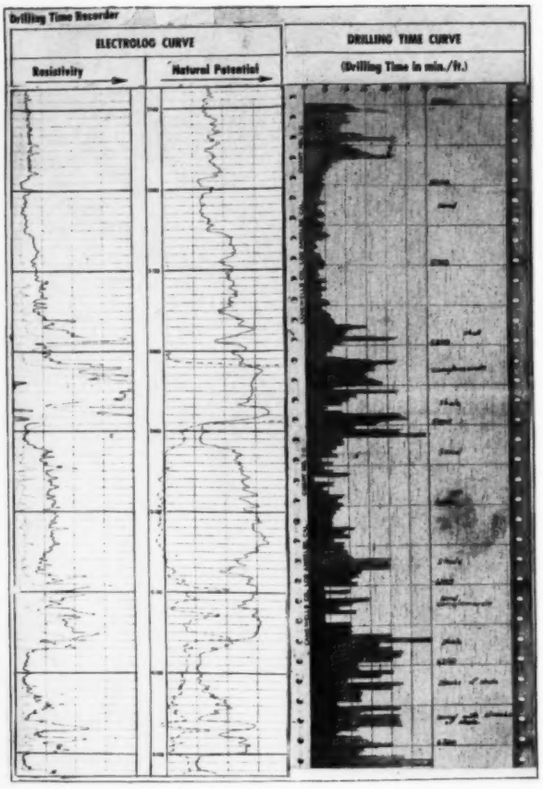
Cameron velocity valve: (1) retainer nut (2) valve seat (3) tubing hanger thread (4) valve cage (5) drop (6) set screw (7) adjusting pin.

LANE-WELLS COMPANY



Lane-Wells tubing floor type packer for fluid and gas lift applications at far left; The shorter packer is upper circulation Type Bo-Cu. Above, the Lane-Wells drilling time recorder log compared to electrilog.

THE Lane-Wells Company has built a simple semi-automatic Drilling Time Recorder capable of producing on the derrick floor a graphical strip chart with the drilling time plotted on an accurate depth scale. The unit is contained in a metal case suitable for mounting on the derrick floor and consists essentially of a visual depth chart across which a stylus moves at a constant speed until reset to its zero position by pressing a trigger. Each time the trigger is pressed the stylus carrier is lifted from the chart and is instantly returned to the left margin by a spring. Pressing the trigger also advances the chart a fixed distance, so that the time lines of various lengths are evenly spaced. The spacing between the lines corresponds with the depth interval which is chosen for timing. Suppose the interval chosen for timing is two feet. The driller has the kelly marked or "striped" at two-foot intervals. The chart is then set so that the depth of the hole is correctly indicated on the depth scale of the chart and the recorder is started simultaneously with the start of drilling by pressing the trigger. The stylus starts making a drilling time line at the proper depth on the chart and runs continuously across the chart at the rate of one inch each ten minutes. When the first two-foot mark on the kelly comes down to the rotary table, indicating that the first two-foot interval has been drilled, the driller presses the trigger. This resets the stylus at zero time and moves the chart the equivalent of two feet in depth. The stylus now starts across the chart again drawing a line the length of which will be a measure of the time taken to drill the second two-foot interval.

Lane-Wells Olympic Type BO-CU Upper Circulation Packers are designed for average formation testing and well washing operations inside casing. The packer is usually run on a section of perforated drill pipe or tubing above a Type BO-C Hook Wall Circulation Packer to obtain an effective pack-off and isolate a specific zone to be tested and produced, or to be washed through casing or liner perforations. The tandem packer assembly is arranged so the lower packer is set in the conventional manner, there being a key in the upper packer to permit the necessary rotation to do so, and shear pins to prevent collapse of the upper assembly until sufficient weight is applied to shear the pins and securely set both packing assemblies.

Lane-Wells Olympic Thin-Wall Type CO Packers are designed especially for gas lift or flow systems when a small, sturdy, and efficient thin-wall packer is required to pack off inside 2 in., 2½ in., or 3 in. tubing. On regular gas lift applications it is used to reduce the orifice through which the oil is being produced, thereby reducing the volume of gas required and increasing production of the well. For producing heavy oil 2½ in. tubing is run on a standard hook-wall packer which is set above the producing zone. The Flow Packer is run on 1¼ in. tubing and set below the standard hook-wall packer. Gas is injected through the smaller tubing to produce oil through the 2½ in. tubing. The reverse procedure can be used to produce light oil.

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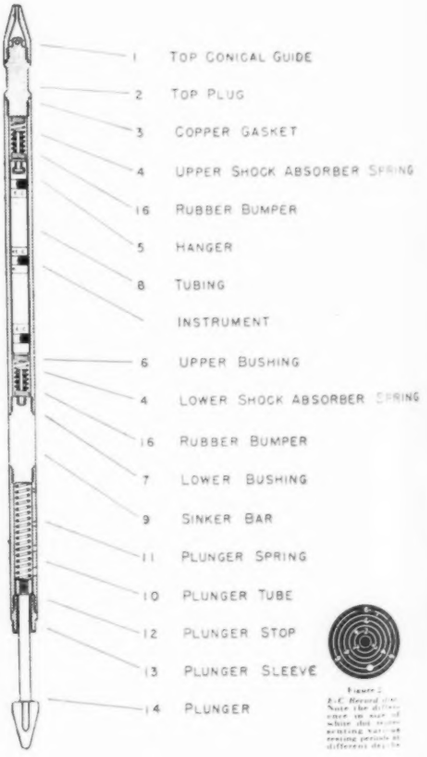
SPERRY-SUN WELL SURVEYING

SPERRY-SUN, during the last year, has developed a new type of inclinometer which represents an advance in hole deviation recording. The instrument is operated by dry cell batteries employing sound electro-chemical principles. A cross-section of the instrument is reproduced herewith. The record disc, shown in the illustration, consists of a special, chemically-treated paper with preprinted circles indicating the degrees of in-

Sperry-Sun's E-C inclinometer.



clination. The record disc is placed in the record disc holder by means of a record disc inserter. A plumb-bob pendulum provided with a floating platinum pin, which is continuously in contact with the upper surface of the record disc, is universally mounted within the instrument, so that it is free to swing in any direction and will always come to rest in a true vertical position. Electric current is provided by three small size dry cell batteries. The current flows continuously from the pendulum to the record disc as soon as the instrument is placed into the protective casing. However, only when the instrument is in a nearly vertical position and the pendulum has come to rest for at least one minute is a record made through electro-chemical action. The continuous flow of electric current produces a small circular white dot at the point of contact with the bluish record disc. The size of the white circular dot varies with the resting period of the pendulum, thus making it possible to take several records at various depths with one round trip of the instrument into the hole, identifying the depth at which the records are taken by the size of the dot.

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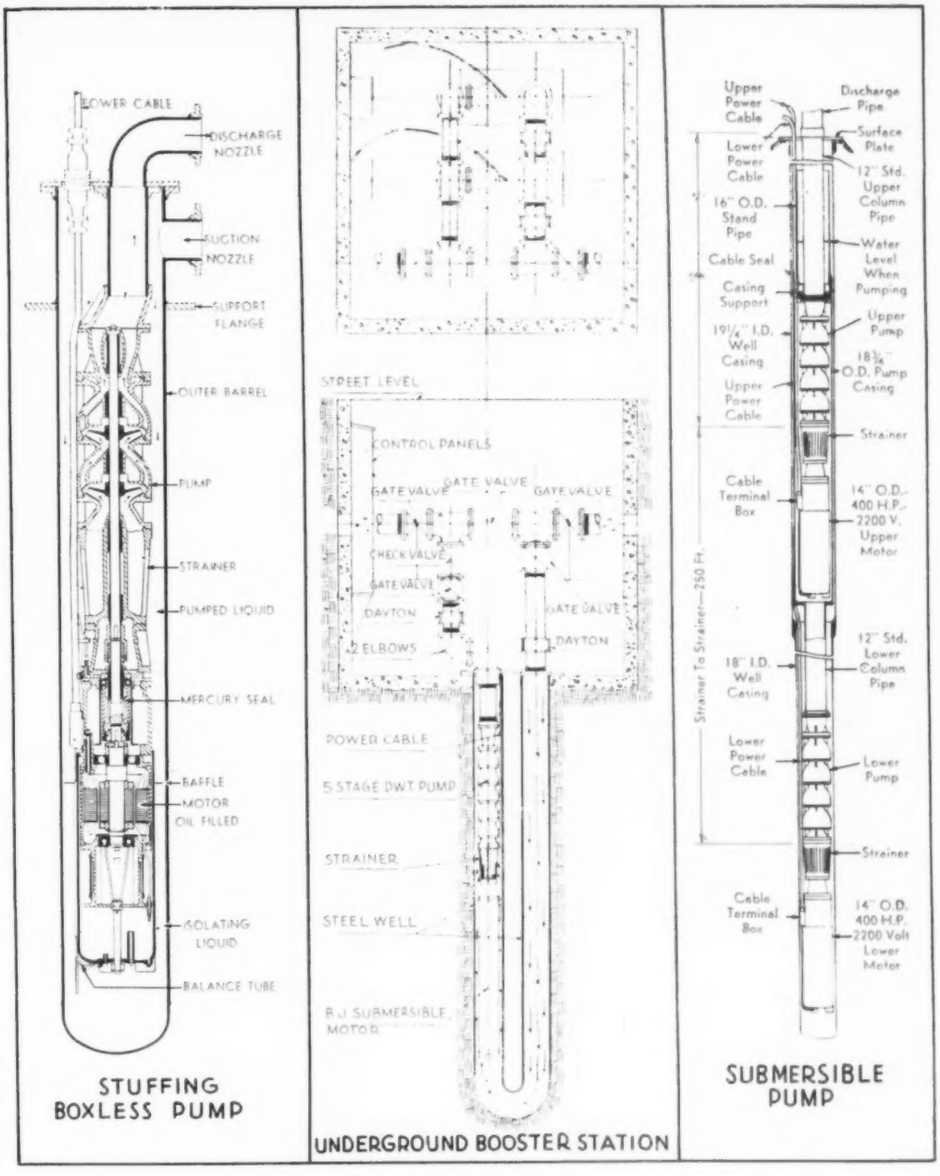
BYRON JACKSON COMPANY

THE accompanying illustration reveals how a pump without packing (stuffing boxless) has been designed by Byron Jackson Co., engineers with a pumping unit consisting of any suitable number of stages, direct connected to a special electric motor. In operation the complete unit (motor and pump) is totally submerged in the liquid being pumped, electric power being conveyed to the motor through a submarine type cable, with either manual or automatic controls situated at any desired point, adjacent to or remote from the installation. The electric motor is sealed in a steel case which is filled with a dielectric oil, and a mercury seal prevents contact of this oil with the pumped liquid.

A second illustration shows how a Byron Jackson submersible pump is used for a bombproof booster pumping station. This unique unit consists of an efficient deepwell pumping element direct connected to a specially designed electric motor, which is isolated in a sealed case filled with dielectric oil. It is thus possible to submerge completely both motor and pump in the liquid being handled. Power is conveyed to the motor through a submarine type cable, the control switch being at any desired point remote from the installation, for either manual or automatic operation. Possible sabotage is avoided by covering the top of the installation either with dirt, or lawn, to correspond with the adjacent surface, so that it is impossible to determine the location of the concrete pit.

By eliminating the conventional long rotating shaft, and utilizing the discharge column for suspending the pump, Byron Jackson submersible



Byron Jackson pumps: from left to right, the stuffingboxless pump, the submersible used in a bomb proof booster station, and the submersible pump.

pumps definitely are in line with the existing program of priorities and conservation of steel. This successful unit combines a deepwell pumping element direct connected to a specially designed electric motor, sealed in a case filled with dielectric oil. Both motor and pump operate completely submerged in the fluid being pumped. Power is conveyed to the submerged motor through a submarine type cable, leading from a weatherproof, tamperproof switch box which can be located at any desired point, for manual or automatic control. A third drawing illustrates how two submersible pumps were installed in one bored hole where it was necessary to pump 5,000 gallons per minute from a depth of 500 ft. These pumps eliminate the conventional long rotating shaft and utilize the discharge column for suspending the pump. Reference to the drawing will reveal the 19¼ in. I.D. well casing with two 400 hp. 1,750 r.p.m. 2,300 volt, 60 cycle, 3 phase submersible motors operating in series, each motor being direct connected to a 4-stage pumping element, with the lower unit located 500 ft. below the collar of the well, and suspended from the upper unit. The upper unit is suspended 250 ft. below the collar of the well, with the lower unit discharging into a 16-in. O.D. standpipe surrounding the upper unit. This standpipe is secured to the discharge pipe of the upper unit, and the entire assembly is suspended from the surface plate at the collar of the well. Standard 12-in. pipe connects the upper unit to two 10-in. horizontal discharge lines. Each motor has a separate power cable and a separate starter, arranged so that the upper motor starts at a fixed time delay after starting the lower motor.

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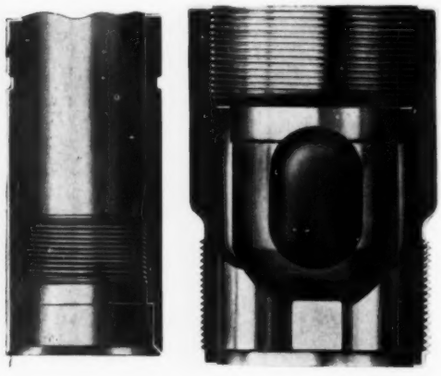
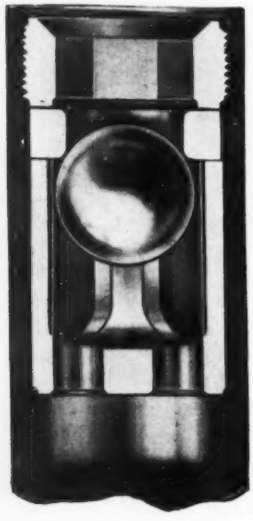
Axelson Manufacturing Company

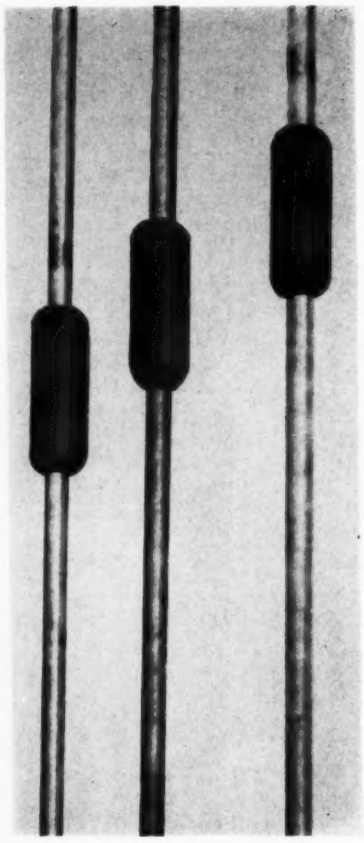
THE Axelson combined collar and cage as shown in the accompanying illustration is a combination of the standing valve and the bottom collar into a single unit. The upper end is threaded externally to fit the internal thread of the jacket, while the lower end has a box thread to fit the standing valve body which holds the seat and ball in position. In pump assemblies using the Perry type plunger it is particularly recommended that the combined collar and cage be used. The Perry valve on an Axelson plunger illustrated herewith reduces gas-locking to the absolute minimum. The entire valve is contained within the lower end of the plunger, allowing free passage of both fluid and gas. This elimination of gas trap space is particularly effective in



deep wells where the high compression ratio would cause a large portion of the working stroke to be lost in compressing and expanding the entrapped gas. The Barnwell feature on Axelson plungers shown in the accompanying drawing incorporates an inwardly-beveled lip which produces a wiping action on the upstroke, thus keeping sand from getting between plunger and liner. The double end Barnwell incorporates this same featuer and in addition, it also has a wiping action on the downstroke. Double action on up and down stroke causes plunger to drop more quickly in heavier oil.



Above left, Axelson combined collar and cage and above right, the Perry valve on Axelson plunger. On the left is an illustration of the Barnwell feature on an Axelson plunger.

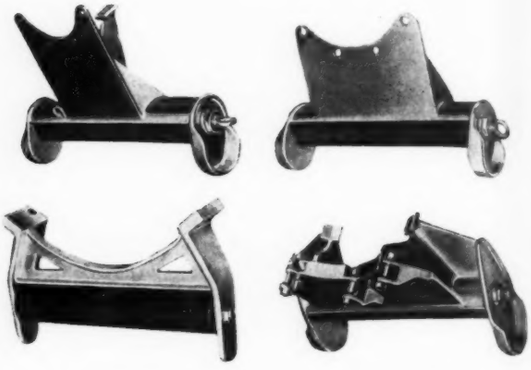


Patterson-Ballagh Corp.

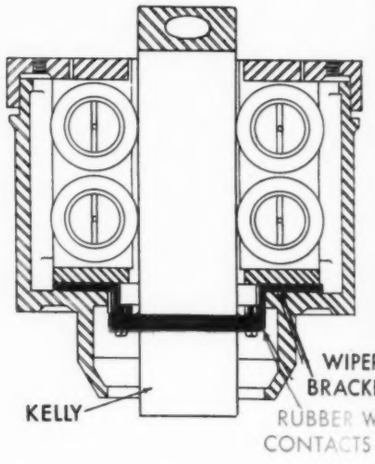
A NEW method of protecting sucker rods has been developed by Patterson-Ballagh Corporation. The protectors are known as the rod style and are molded directly onto the polished rod of a standard pony rod. These protectors which are illustrated in the center of this page have just enough clearance so that the rod will slide inside the protector instead of against the rough tubing. The rods should be at least a foot longer than the stroke of the pump.

A new and inexpensive attachment for effectively wiping rotary mud from the kelly to protect the rollers from wear has been developed by Patterson-Ballagh Corporation. These are available for roller bearing kellys in most sizes for Baash-Ross, Emsco and Ideco-Boykin types. Octagonal, hexagonal and square rubber wipers are available to fit the various shapes of kellys. In the type illustrated on the center right hand side of this page the kelly wiper is bolted in the bottom portion of the rubber bearing assembly. Other assemblies are available with castings to fit the rubber wiper.

A diversity of designs of swivel bail bumpers for application to practically every type of rotary mud swivel have been developed by Patterson-Ballagh Corporation. Each design of swivel takes a different casting for proper fit to the respective bodies in order to accommodate the rubber bumper. The illustration shows a few of the fittings for various types of swivels. The rubber bumper element is replaceable. It is usually five in. in diameter, 32 in. long in the double style and six in. long in the short style, with exceptions for a few special designed bumpers. The double style is used where triplex hooks or connectors are used and will fit all elevator bails.



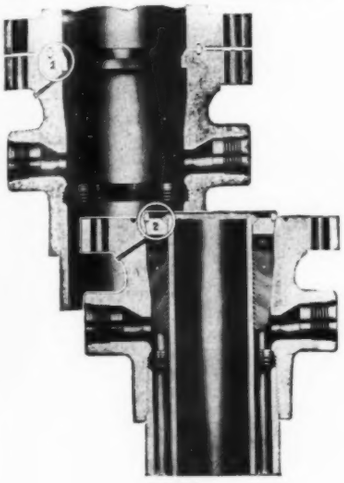
Left, a Patterson-Ballagh development for protecting sucker rods; above some of the 15 different types of Patterson-Ballagh swivel bail bumpers; below, a Patterson-Ballagh attachment for wiping rotary mud from the kelly.



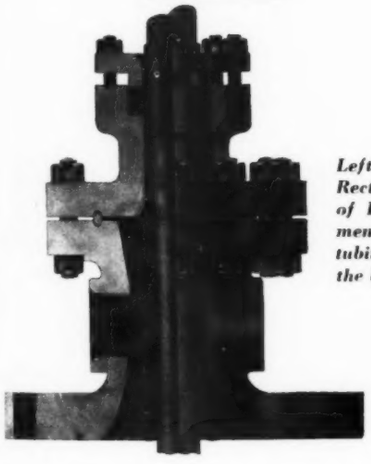
Rector Well Equipment Co.

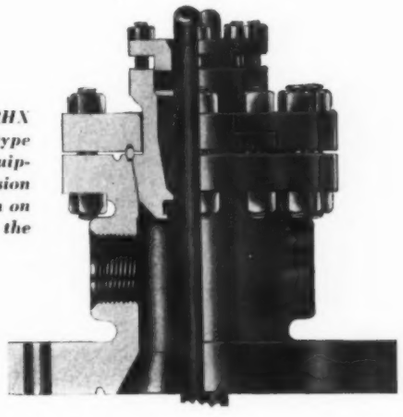
THE RHX "Rectorhead" illustrated opposite, is a modification of the type RH slip suspension Rectorhead, to permit the use of higher pressure tubing head, flanged directly to a lower pressure casing head which, although deviating from API standards, is recognized as an economic expedient by many operators. After oil string is set, a 10,000 lb. test tubing head, with 900 series flange on bottom end, may be flanged directly to the casing head, using the restricted ring groove. The use of the restricted ring groove, by exposing less area to pressure than the stndard ring groove for that particular flange size and series, permits the tubing head to be tested and used at the next higher pressure rating. During drilling operations, the blow-out preventer is flanged to the casing head, using standard ring groove. At this time the protector ring is in place to guard the inner ring groove from damage by bit or kelly. This

ring, as shown in the illustration has the same bore as the pipe, and the lip between the flanges does not interfere with the outer API seal ring. After pipe is set, the blowout preventer is raised, slips set, and welding ring applied and welded.



The slip suspension tubing head shown on the left, has the regular type double flanged body with side outlets and a set of three-piece slips mounted in the seat in the upper end. The bonnet is extended to allow height of upset from slips to packing. The packing seals around the coupling with a gland sealing arrangement. The design allows the user to set packers, wash out screen, then set tubing when setting cannot be detremined otherwise. The slip suspension tubing head shown on the right employs a one-piece hanger interchangeable with other mandrel hangers. This hanger consists of a "V" type packing ring in bottom with "V"" type lip packing, sealing ring to pressure seal around the tubing below the slips. The three-piece assembly is packed above with a split junk ring, neoprene packing and gland. The head is used for setting packer and washing behind screen. It is stripped over last joint of tubing before making up, slips are removed while washing or setting packer and inserted when tubing is in required position. The hanger body passes through blowout equipment.





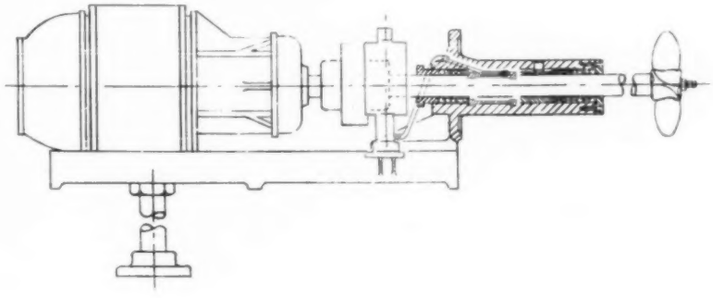
Left above, the RHX Rectorhead; one type of Rector Well Equipment slip suspension tubing head is shown on the left, another on the right.

Engineering Laboratories, Inc.

THE Perco Sampler illustrated on the right is the latest addition to Engineering Laboratories, Inc., line of petroleum engineering instruments and was designed, developed, and field tested by the research department of the Phillips Petroleum Company. The instrument consists essentially of 1½ in. O.D., by 1 in. I.D. sample chamber, having at either end tapered type check valves. These spring loaded valves, which are held open while the instrument is being run in the well by an interlocking device, seat in replaceable tapered neoprene seats, assuring positive seals with extremely small differential pressures. The spring loading and holding open of the valves during running of the instrument in the well is by means of a shear pin rupturing of which is with jars built integral with the unit. A sharp pull on the wire line when the instrument reaches the sampling depth will shear the pin, allowing the upper valve to close, actuating the interlocking device which releases the lower valve.

EASTERN ENGINEERING COMPANY

A SIDE entering mixer, illustrated below, has been designed by Eastern Engineering Company expressly for gasoline blending. These mixers are available for tanks ranging in capacity from a few gallons to 100,000 bbl. A single unit will handle tanks up to 25 ft. in diameter; larger tanks may require multiple installations. The mixer is mounted on heavy cast rib bases which support motor and stuffing box as an integral unit assuring perfect rigid alignment. The stuffing box incorporates a special self-aligning design. Units are available in sizes from ¼ to 25 hp. with speeds of 200 to 1700 r.p.m., equipped with semi-enclosed, totally enclosed and explosion proof motors.

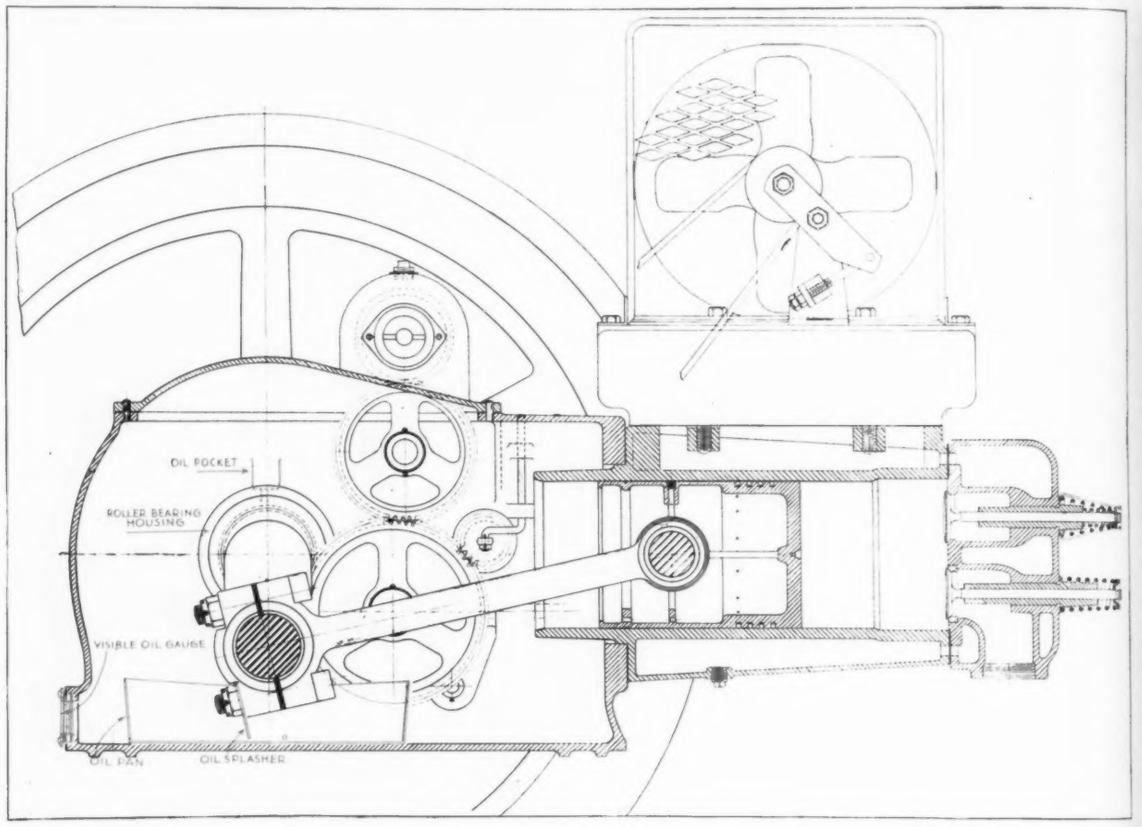


Eastern Engineering Company's side entering mixer for gasoline blending.

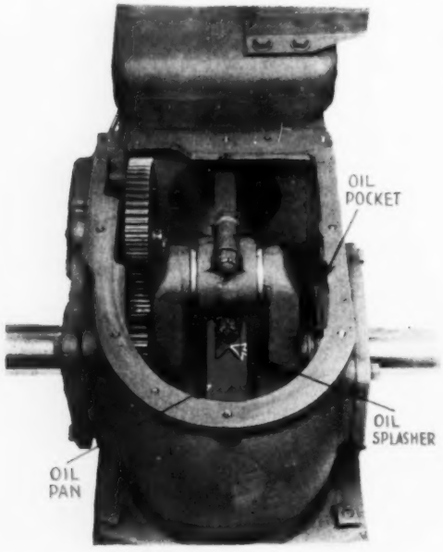
THE FAIRBANKS, MORSE COMPANY

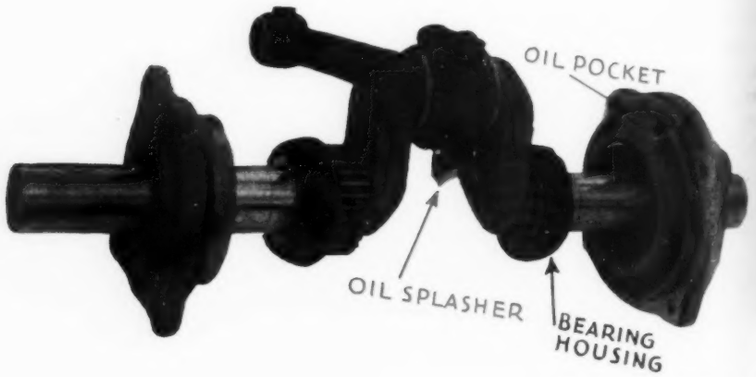
THE new Fairbanks-Morse "ZC" pumping engine for use on pumping wells has been designed without troublesome thermostats or radiator covers relying on vapor cooling to hold the temperature of the engine absolutely constant regardless of load or outside temperature. In summer or winter the "ZC" engine operates at a constant temperature. A vent prevents any formation of pressure or vacuum in the radiator. Because the radiator and its cooling fan condense steam as rapidly as it is generated, no steam can escape through the vent as long as the fan is operating, hence no water on antifreeze is lost from the system. With this system all surfaces have uniform temperatures. Hot spots are eliminated. Vapor cooling is the equivalent of having a thermostat on each and every square inch of cooling surface. Oil sludging is greatly reduced because water is driven out of oil at the boiling point of water—the temperature maintained with vapor cooling. Overheating is eliminated since the temperature cannot rise above this boiling point. No lime scale can form in the jacket or radiator. Elimination of thermostats, hose connections, frequent oil changes and water pump repairs help cut unnecessary operating expense.

Extra-heavy pumping type flywheels on the new "ZC" engine effectively smooth out the engine explosions to give smooth operation to the pumping unit and rod string. The heavy flywheels average the power to the engine. Energy is stored in the flywheels during the light load portion of the cycle and is given up at the peak demand when the rod string is lifted. The wide variations of load in pumping service are reduced to a minimum. The spring on the automatic intake valve has been chosen to limit the power output of the cylinder to a safe maximum for continuous operation. The fixed spring tension limits the fuel charge taken into the cylinder; it is impossible to overload the "ZC" engine. A hot-spark magneto together with gasoline fuel insures a prompt take off even on the coldest mornings. After the engine starts, it is only a matter of a few seconds to switch to natural gas; however, the engine may be operated continuously on gasoline if desired.



Fairbanks Morse engines for oilfield service diagrammatically illustrated at right with details shown below. These engines are equipped with condensing radiator and belt driven fan on which the vapor system of cooling is used. In the accompanying illustrations red indicates the self oiling features and blue the location of Timken bearings.





FLUID PACKED PUMP COMPANY

FLUPACO PUMPS, one of which is illustrated on the left have a barrel that is one solid piece of special alloy steel end to end. Machined, heat treated and honed in one-piece, the barrel is uniform throughout and maintains true alignment at all times. In order to obtain the unusually high factors of hardness and precision, carefully controlled heat-treatment is necessary. The Improved Insert Pump barrels and the Groove Seal Pump barrels are first heat-treated in automatically controlled furnaces to insure accuracy of hardness, after which each barrel is reheated in a liquid heat by the use of a special furnace; and then they are quenched, inside and outside while being rapidly rotated in a rolling-mill type straightening jig. Following the rough honing operation, the barrels are then finished honed, during which time they are constantly checked and rechecked for straightness, deflection and uniformity of bore, roundness and other important dimensions. The hardening methods used on the one-piece pump barrels produce a Brinell number of 627 and a Rockwell "C" number of 64 to 70 on the wearing surfaces of the Flupaco and honed pumps compared with Brinell hardness of 150 to 170 and Rockwell "C" 6 to 14, in untreated steel pumps. Thus the specially hardened and honed pump barrels are from four to eight times harder than steel barrels of standard oilwell pumps.

A cross-sectional view of one of these processed pump barrels on an enlarged scale reveals that there is a deep and exceedingly hard wear-resistant surface on the inside, a hardened case-surface on the outside and a tough ductile core between which provides for the extra strength and rigidity of the hardened and honed pump. This barrel will effectively resist shock and fatigue, having a tensile strength of some 145,000 p.s.i. which is more than sufficient to withstand pumping pressures below depths of 12,000 ft. The consolidation into one-piece, a hardened and honed pump barrel, eliminates the many short liners assembled in a jacket which go into the make up of the ordinary insert liner pump barrel. The minute differences in surface hardness and internal diameters of each short liner produce uneven wear and further, the jointed construction loses alignment easily. This mis-alignment, even though it be slight, will cause the plunger to stick and the pump, if it is not completely stuck, will at least understroke. The true alignment possible with the one-piece barrel permits the full length pump travel on every stroke; and also makes a smoother operating motion for uninterrupted pump service.

The new process for hardening and honing a one-piece, full length pump barrel has demonstrated that less steel, made harder and tougher, improves pump efficiency and the one-piece barrels eliminate needless bulk of conventional types. Increased precision-hardness gives two to five times ordinary wear and the hardened rigid barrels will not bind plunger in crooked wells. The precision honed barrels provide for smoother plunger operation, while the one-piece barrels require less steel, and fewer replacements. Finally, these processed barrels can be applied effectively to any pumping condition to increase production returns by reducing maintenance.

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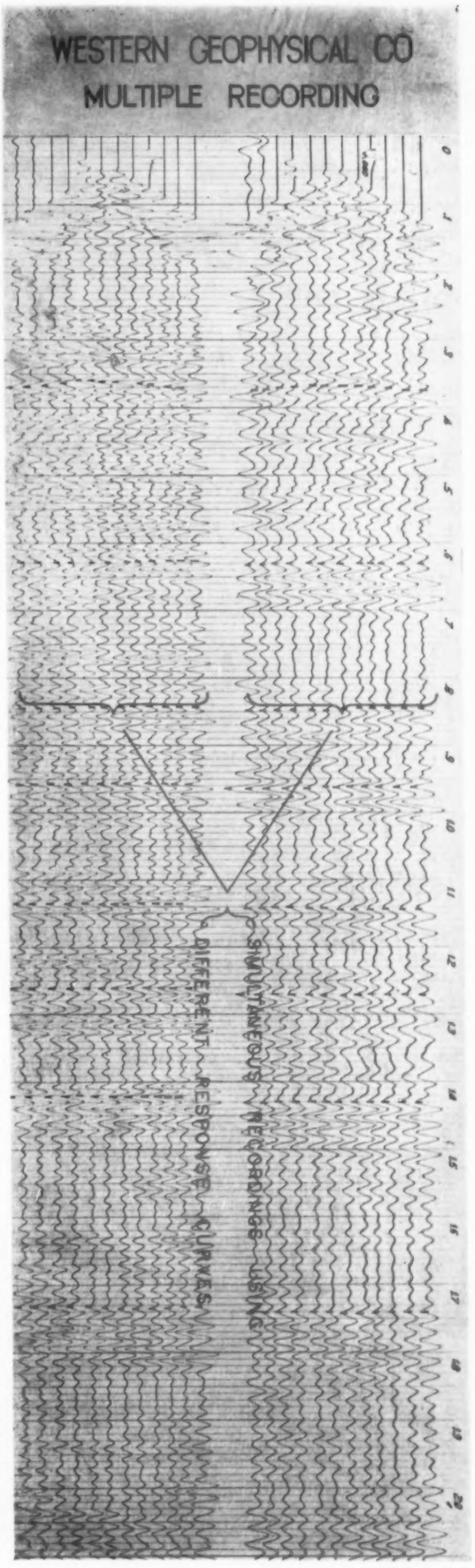
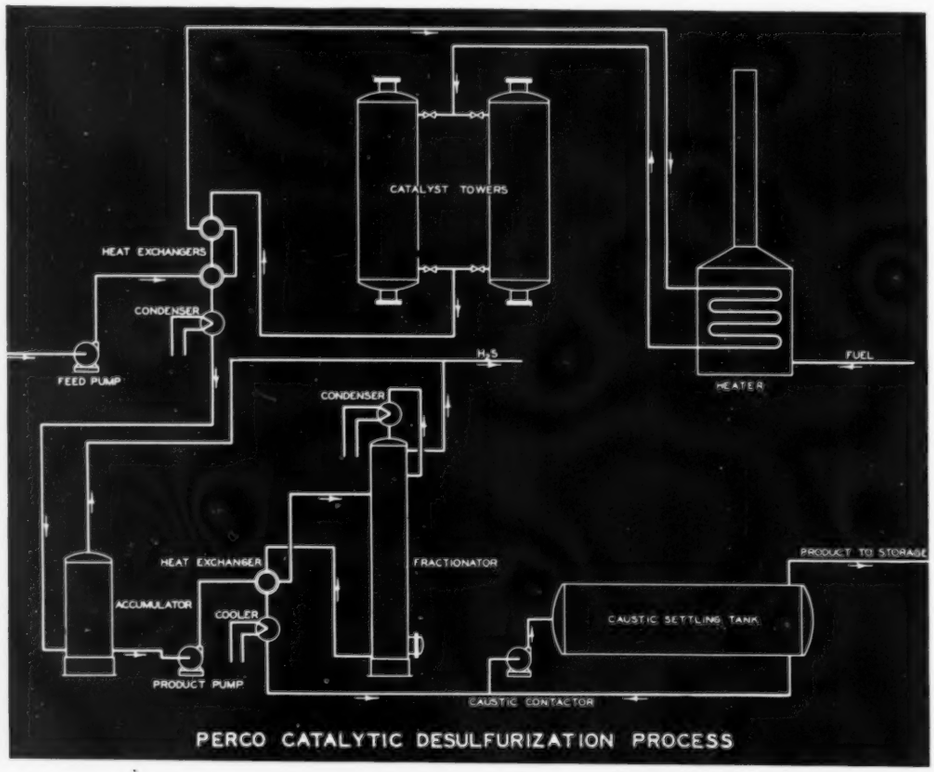
WESTERN GEOPHYSICAL COMPANY

IN SEISMOGRAPH RECORDING, the frequency and character of reflections vary considerably according to surface and subsurface conditions and the depth of the reflecting beds. It is necessary to use amplifying systems which employ filters with different types of response curves in order to record all obtainable reflections. In order to secure the desired results, several recordings with different types of response curves must be taken. With the recently developed multiple recording unit of the Western Geophysical Company, it is possible to take separate recordings, such as the one reproduced on the right, simultaneously using different response curves on one film. The same seismometer output is fed through either two or four different sets of amplifying systems and is recorded on the same film. On the 24-trace film—combinations of four groups of six traces, two groups of twelve traces, or one group of twenty-four traces are readily obtained simply by operating group switches. Multiple recording is advantageous not only because time and explosives are reduced, but because the simultaneous recordings on one film allow the reflections to be studied and classified more accurately than when using separate records which vary somewhat with each shot. In this unit is also the latest type of completely automatic volume control. It has a range such that uniform amplitude control is obtained from the first breaks to the completion of the record without any distortion.



PERCO DIVISION OF PHILLIPS PETROLEUM

THE Perco Catalytic Desulfurization process is an economical method of removing organic sulfur compounds from gasoline. The type of sulphur compounds removed include not only the mercaptans, but also sulfides, disulfides and others, except that cyclic sulfur compounds are not greatly affected. Since these compounds occur in varying proportions in different types of gasolines, the amount of sulfur reduction obtained will vary, but will be, in general, 40-60 percent for cracked gasoline, 60-98 percent for straight-run gasolines and 90-99 percent for natural gasolines. These reductions in sulfur content result in many benefits, the principle one being the increase in the tetraethyl lead response of the gasoline. It is a well established fact that sulfur compounds in motor fuels have a very deleterious effect on their response to tetraethyl lead, and the desulfurization of these gasolines results in increases in the leaded octane numbers of as much as ten points or more.



PERCO CATALYTIC DESULFURIZATION PROCESS

A general flow diagram of the process is reproduced herewith. The feed is vaporized by heat exchange with the product leaving the catalyst tower. The vapors then go to a heater, the discharge temperature of which is maintained in the neighborhood of 750 deg. F., the exact operating temperature depending upon the product being prrocessed. The superheated vapors are then passed through the catalyst bed where the organic sulfur compounds are decomposed to hydrogen sulfide. After cooling and condensing, the hydrogen sulfide is removed by whatever means is most economical, such as fractionation or caustic washing. Only moderate pressures are required by the process, the pressure on the catalyst tower being generally maintained at fifty pounds or less.

Throughputs are from 100 to 300 bbl. of liquid feed per ton of catalyst per day, depending upon the nature of the product being processed. Catalyst life is usually quite long, permitting operating cycles of as much as thirty days or more at average treating rates. The catalyst cost in such cycles when spent catalyst is discarded is of the order of one cent per barrel. Where the nature of the feed stock is such that the catalyst life is appreciably shortened, equipment for regeneration may be provided.

The following table illustrates the magnitude of the increased volume from desulfurizing a typical base stock:

100 OCTANE AVIATION BLEND

	Sample A Undesulfurized	Sample A Desulfurized	Sample B Undesulfurized	Sample B Desulfurized
Sulfur in Base Stock %	0.057	0.013	0.012	0.001
Synthetic Blend Agent Required with 4cc. TEL, %	61.4	46.4	48.0	44.0
Increase in 100 octane Gaso. for given volume of Blend Agent, %	—	32.3	—	11.4

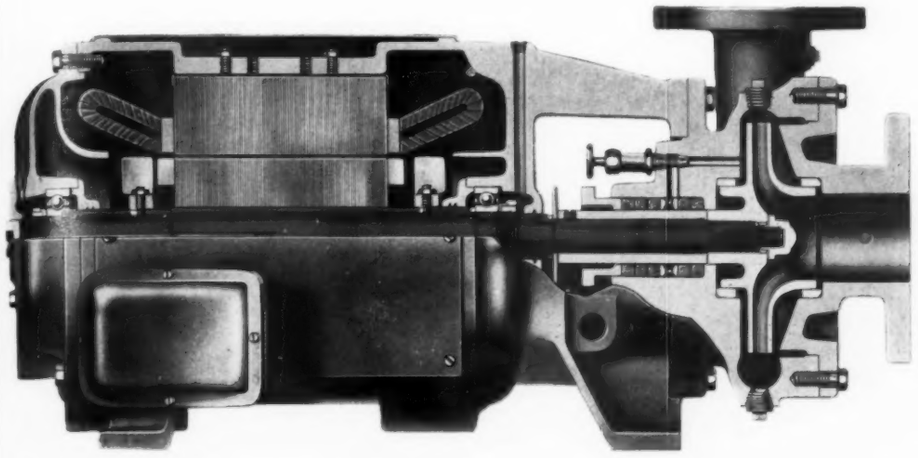
Eastman Oil Well Survey Corp.

A NEW TYPE of full-gauge deflecting tool, which is self-orienting and is run into the hole without the use of orienting clamps or surveying instruments, has been developed by Eastman Oil Well Survey Corp. The new tool is used for hole drilling and sidetracking cement plugs. The tool automatically orients itself on the bottom to the low side of the hole and can be pointed to drill in any desired direction. The only survey operation necessary before running the tool is that a drift indicator or a single-shot reading be taken. The tool is then run on the drill pipe in the same manner as running the ordinary bit. When the tool is at bottom, the pump is started to clean the hole by circulation. The drill pipe is then lowered until a weight approximately equivalent to that of five strands of 4-inch drill pipe is brought to bear upon the tool, releasing the locking device so that the balls within the tool are free to roll to the low side of the hole. Upon lifting the string so that the tool is slightly off bottom, the lower section is automatically pointed toward the low side of the hole by the wedging action of the balls.

Full-gauge, self-orienting deflecting tool developed by Eastman Oil Well Survey Corp.

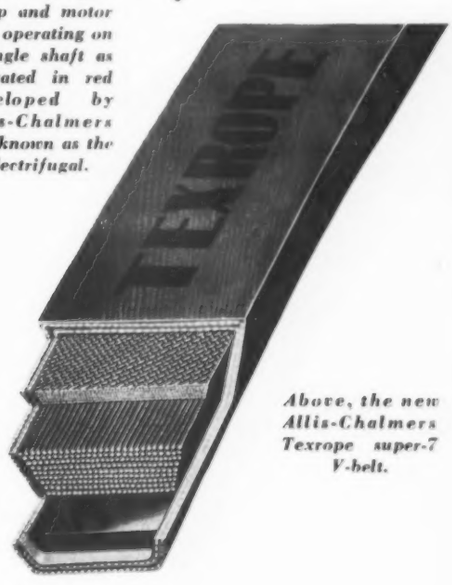
ALLIS CHALMERS MANUFACTURING COMPANY

THE electrifugal pump, illustrated in the center of this page was designed and is being manufactured by Allis-Chalmers, as a complete unit with pump and driving motor on a single shaft shown in red in the accompanying illustration. This design results in a unit that is far stronger mechanically; that has fewer parts, fewer machined fits, less chance for misalignment. Elimination of feet in the center of the unit and placing them farther apart at each end gives unusual stability and rigidity of mounting. All parts are readily accessible and are easily replaced. The pump and the motor can be completely dismantled in a few minutes. Even the complete stator assembly can be removed from the motor yoke. This makes it possible to change the rating or the voltage of the motor to suit changing conditions of operation. The stuffing box gland is even more accessible than in the Allis-Chalmers SSUnit Pumps. Also, the stuffing boxes are made longer to accommodate at least five rings of packing, cutting the chance of leakage to a minimum. Standard electrifugal units are equipped with the new special splash-proof-motors with bottom intake and discharge of ventilating air, and air passages baffled to safeguard the motor from liquids. The cover surrounding the motor is made of copper bearing steel except where the pumps are to be used in corrosive atmospheres such as chemical plants. In this case the covers may be made of stainless steel. On all units the motor stator frames and end bells are made of cast iron. Rating plates on all units are of non-corrosive material, easily read even after years of hard service. Motors range from ¾ hp. at 1,800 r.p.m. to 25 hp. at 3,600 r.p.m. They are made in two styles, with suction and discharge nozzles cast integral with the casing and with the discharge nozzle and stuffing box cast integral.



Left, an integral pump and motor both operating on a single shaft as indicated in red developed by Allis-Chalmers and known as the Electrifugal.

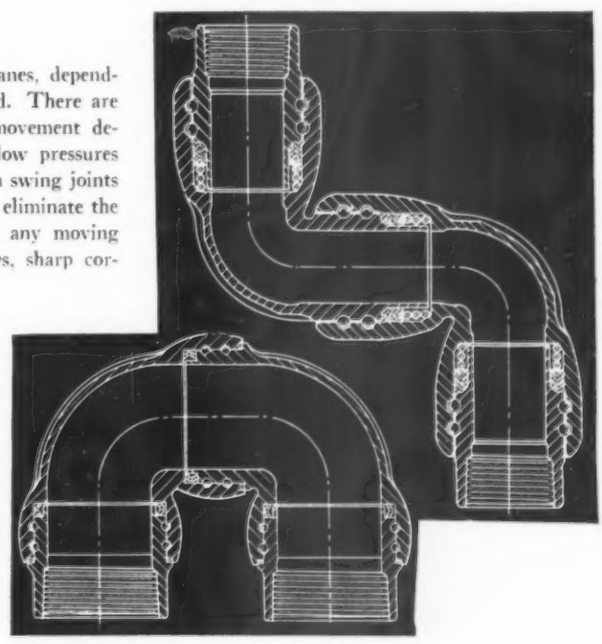
ALLIS-CHALMERS has recently made fundamental improvements in V-Belt structure. All the company's V-Belts are now of the new "Super 7" laminated design, based on the Vogt formula, to include more strength and flexibility, greater service and longer life. The cords in the new "Super 7" belts illustrated below are smaller, permitting the use of more cords per belt with a resulting greater strength and less stretch. Each cord is individually imbedded in heat dissipating rubber to reduce internal belt degeneration. These belts are made in matched sets to assure uniform, smooth running, highly efficient drives.



Above, the new Allis-Chalmers Texrope super-7 V-belt.

CHIKSAN TOOL COMPANY

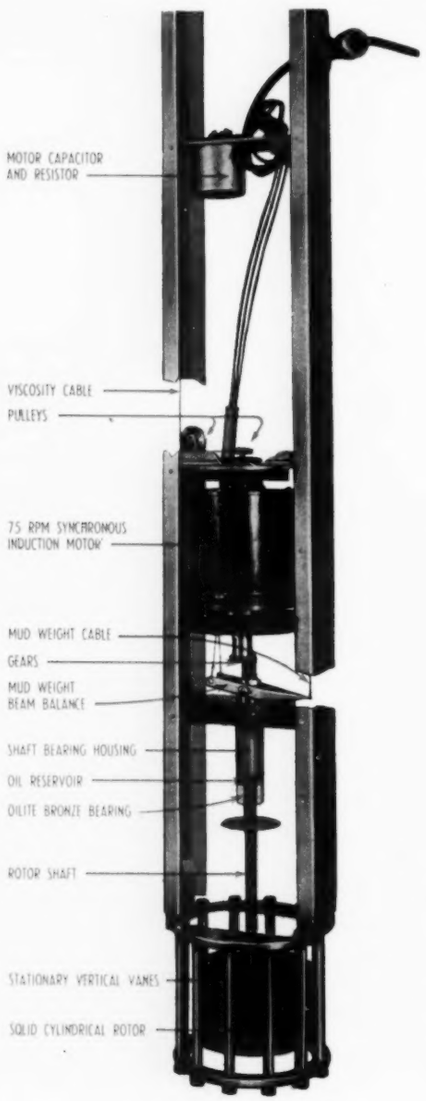
CHIKSAN Ball-Bearing Swing Joints are designed to give continuous flexibility and service with the smallest possible maintenance attention and upkeep cost. The swing joint, diagrammatically illustrated at the right, takes on particular importance at this time since it offers an excellent substitute for rubber in rotary drilling hose circulating heads, mud guns, loading hose and elsewhere. The rotating members of each Chiksan swing joint are held together by double rows of ball bearings. These perform two functions: first, they maintain a pre-regulated load upon the packing element, keeping it always pressure- or vacuum-tight, and second, they carry all radial loads and hold the joint in alignment under all conditions. All pressure or load is transmitted through the balls and their races. The stress required to force apart the members of any Chiksan swing joint must, therefore, be equal to the shearing strength of the metal which is many times the rated capacity for each type of Chiksan swing joint. Full 360 deg. rotation is provided in one, two and three planes, depending upon the style of joint specified. There are 8 different styles to provide any movement desired and designed for high and low pressures and high temperatures. All Chiksan swing joints have a streamlined exterior so as to eliminate the hazard which always accompanies any moving apparatus on which ther are angles, sharp corners or protruding parts.



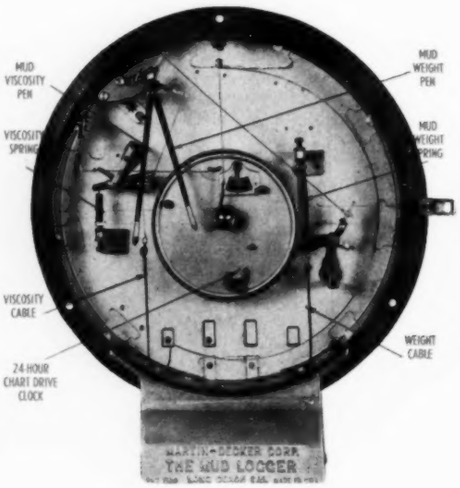
Sections showing construction of Chiksan swing joints; elbows have increased diameters to compensate for bends assuring maximum flow with minimum pressure drop.

Martin-Decker Corporation

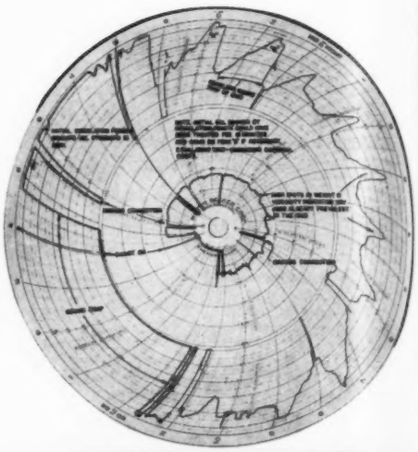
THE Martin-Decker mud logger illustrated on this page continuously records the weight and viscosity of drilling mud. The record is graphed on a polar type, dual track, twenty-four hour chart, using conventional box type ink pens. The viscosity is recorded in units of centipoise, and the weight in pounds per cubic foot, pounds per gallon, or their equivalent. The lower portion of the instrument contains the mechanism which measures the weight and viscosity of the drilling fluid and transmits these measurements mechanically to the visible recorder immediately above. At the bottom of the mud logger, designed for submergence in the mud, is a smooth, cylindrical, solid, metallic rotor. It is enclosed within a cage of twelve stationary vanes. The rotor is revolved at a constant speed by a small electric motor and at the same time suspended by a weighing mechanism. Since viscosity is defined as the internal resistance of fluid to shear, and as the rotor shears the mud between its surface and the vanes, the torque exerted by the rotor is directly proportional to the viscosity of the submerging fluid.

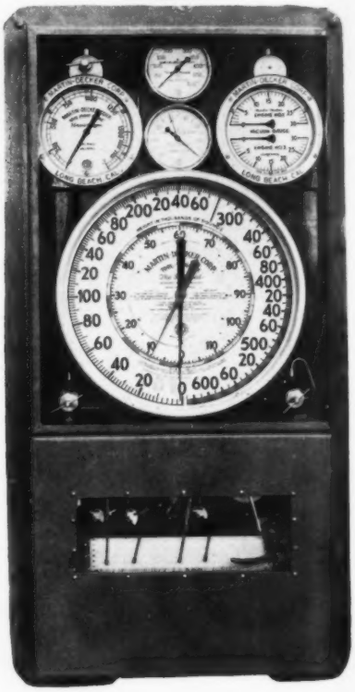


The new Martin-Decker drill-logger provides the driller with a complete visual and automatic log of rig operations as they are taking place. The instrument consists of the sealtite drilling control instrument, which has been rearranged to accommodate a 5-pen recorder. The recorder is of new design, incorporating a strip type chart and pens which record horizontally on the chart

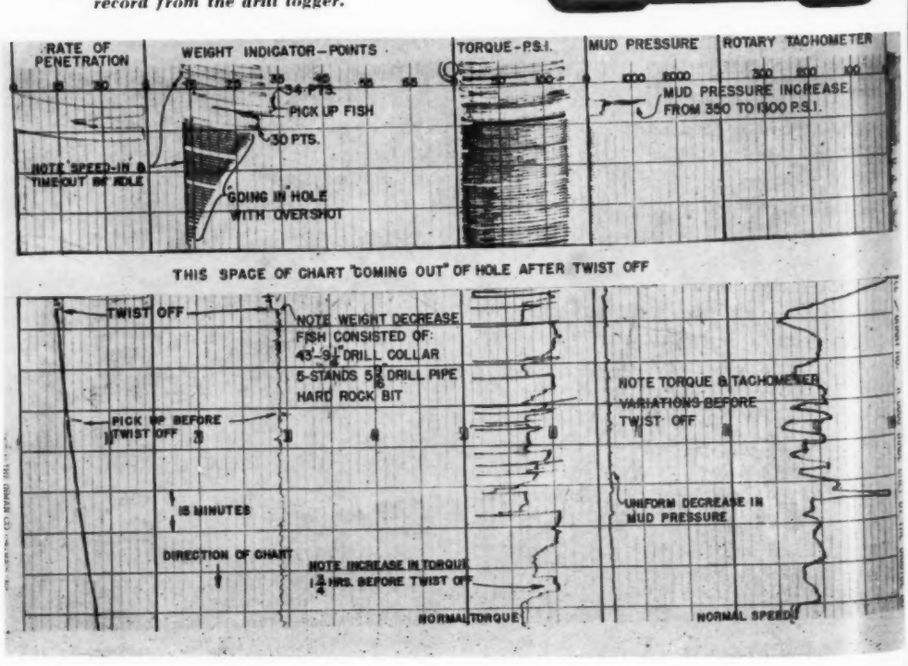


moving vertically at a rate of 2 inches per hour. The single chart contains a record of weight, rotary speed, mud pressure, torque in drill pipe and rate of penetration.





Left, the Martin-Decker mud logger showing the various operating parts. Above, the mud logger recorder with door off and chart removed. Above right the chart from the mud logger with explanatory remarks. Right, the Martin-Decker drill logger and below, the record from the drill logger.



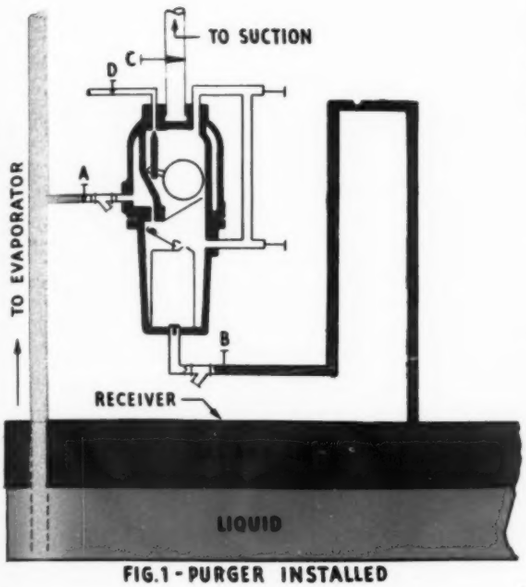


FIG.1 - PURGER INSTALLED

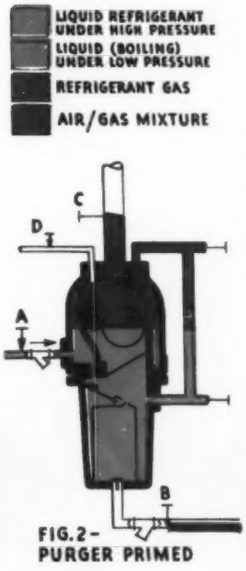


FIG.2 - PURGER PRIMED

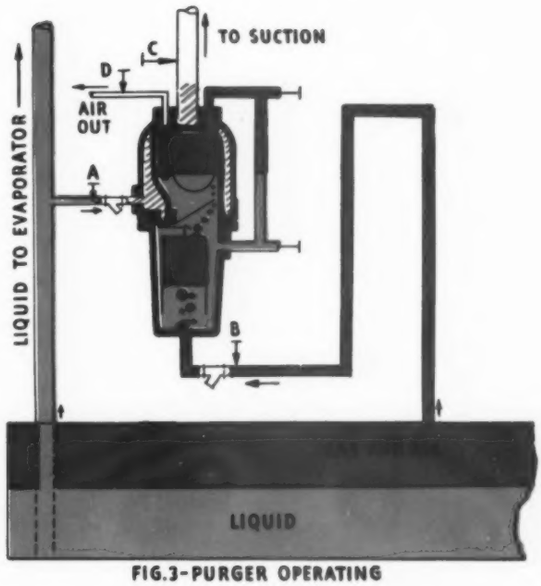


FIG.3 - PURGER OPERATING

Armstrong Machine Works

THE Armstrong foul gas purger, operation of which is diagrammatically illustrated on this page provides a method of removing non-condensible gases from a refrigerating system. The upper part of the cap is made larger and with a jacket to provide more storage space for liquid refrigerant and more condensing surface for refrigerant gas. A needle valve controlled by a ball float removes the air as fast as it accumulates. The mixture of air and refrigerant gas that passes through the bucket vent is diverted against the cold wall between the separating chamber and the refrigerating jacket. The refrigerant gas condenses because of the lower temperature. The air collects and depresses the liquid level which causes the ball float to sink and open the air valve. When all the air has been purged, the pure refrigerant gas that passes through the bucket vent will all be condensed. The liquid level in the separating chamber will not change, and the air valve will remain closed.

The operating principle of the new Armstrong snap action air trap can be understood by noting the accompanying diagram. The ball float is connected to the short valve lever through a flat strip of stainless spring steel. In the closed position, this spring is bowed downward. As water enters the body of the trap, the ball float rises and stores up energy in the spring. Just before the ball float reaches the top of the trap, the spring bends past dead-center and the stored-up energy snaps the valve wide open. In this position, the spring is bowed upward. As the water level drops in the trap body, the cycle is reversed and the valve snaps shut. The snap action eliminates the possibility of dirt holding the valve open. There is no dribbling and the mechanism is self-priming.

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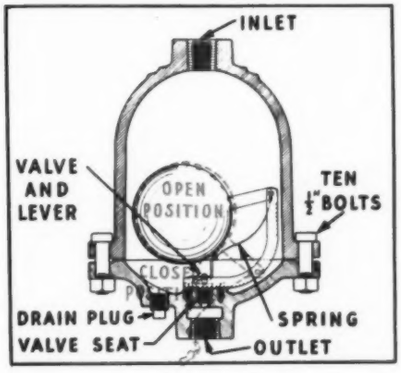

Top the operation of the Armstrong foul gas purger; red indicates liquid, blue indicates gas and air. Above, diagram of the operating principle of the Armstrong snap action air trap.

Viking Pump Company

THE heavy duty rotary pump recently improved by the Viking Pump Company, and illustrated below, is available for truck mounting to deliver petroleum products or it may be mounted for V-belt drive, direct connected, back geared or double back geared. The integral thrust bearing eliminates end play or any chance of distortion. The extra long stuffing box allows for added packing and lantern ring avoiding leakage at this point. A steam jacketed back flange and head may be added to heat viscous fluids while pumping. A relief valve on the head insures the pump against damage from sudden closing of discharge lines.

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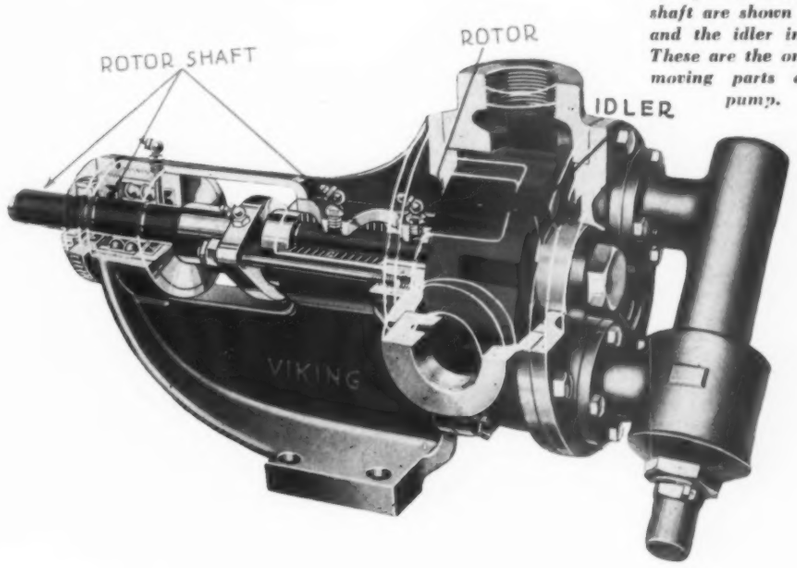
Improved Viking pump for the petroleum industry: the rotor and shaft are shown in red and the idler in blue. These are the only two moving parts of the pump.



RALPH N. BRODIE COMPANY

THE Brodie Meter, equipped with automatic repeating quantity control illustrated on the right is a barreling or packaging meter that can be set to handle liquids in multiples of quarts, gallons, litres and dekalitres up to 999 volume units. It has been especially designed for every filling service where fast, accurate, economical barreling or packaging of petroleum is required. With two 3-figure quantity setting indicators, one dial is progressively adding up to the predetermined quantity, while the other dial automatically resets itself at zero. This reciprocating cycle is continuously repeated over and over again, until the desired number of containers is filled. Quantity control is thereby entirely out of the hands of the operator, after the initial setting, except for starting the flow and emergency shut-offs. At any time during the filling operation, the total number of barrels or packages that have been filled can be determined from the 5-figure container totalizer. Volumetric totals are recorded behind a key-locked-blind. To compensate for changes in specific gravity and temperature, a manually operated compensating adjustment known as the Brodie Quantrol Compensator is supplied as special optional equipment. After determining the actual temperature and specific gravity of the liquid to be measured, the proper setting on the compensator is ascertained from a chart. This adjustment compensates for any expansion or contraction of the liquid, automatically correcting the volumetric measurement to the equivalent of the liquid volume based on 60 deg. Fahrenheit.

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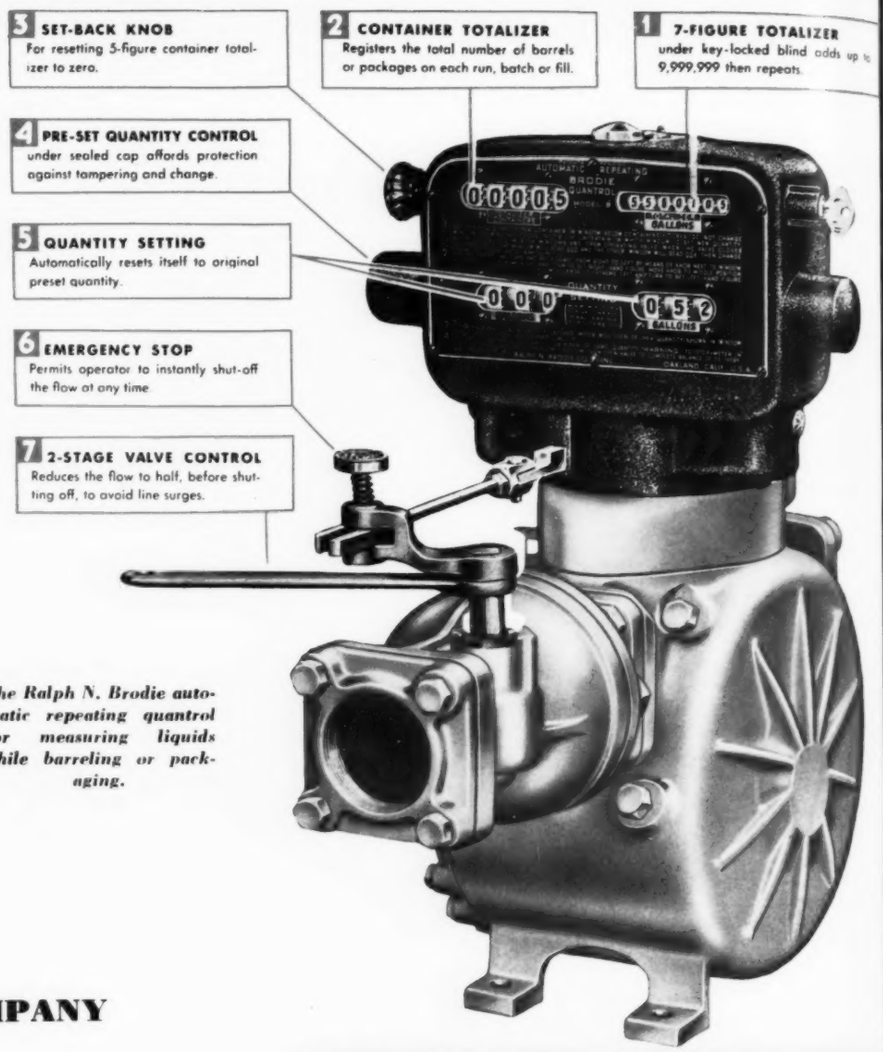
3 SET-BACK KNOB
For resetting 5-figure container totalizer to zero.
2 CONTAINER TOTALIZER
Registers the total number of barrels or packages on each run, batch or fill.
1 7-FIGURE TOTALIZER
under key-locked blind adds up to 9,999,999 then repeats.
4 PRE-SET QUANTITY CONTROL
under sealed cap affords protection against tampering and change.
5 QUANTITY SETTING
Automatically resets itself to original preset quantity.
6 EMERGENCY STOP
Permits operator to instantly shut-off the flow at any time.
7 2-STAGE VALVE CONTROL
Reduces the flow to half, before shutting off, to avoid line surges.

The Ralph N. Brodie automatic repeating quantrol for measuring liquids while barreling or packaging.

MERCO CENTRIFUGAL COMPANY

THE Merco centrifugal concentrator may be employed to recover valuable weighting material from waste mud, to maintain viscosity without loss of weighting material, and to reduce salt water without loss of weighting material. In the first case the concentrator is set up adjacent to the waste mud sump where the mud is first gunned up and diluted to about 72 lbs. per cubic foot. It is then screened to take out the cuttings and sand and then put through the concentrator. The concentrator discharges the weighting material in a mud of 100 to 145 lbs. per cubic foot and this is blended with mud as desired. In the second and third cases the concentrator is placed in the circulating mud stream after the screening operation. The mud going to the concentrator is first diluted to 72 lbs. and the concentrator decants off fresh and salt water and surplus colloid, all with no substantial loss of weighting material.

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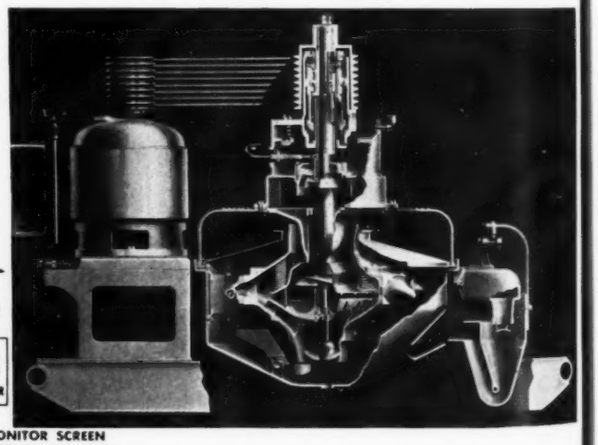
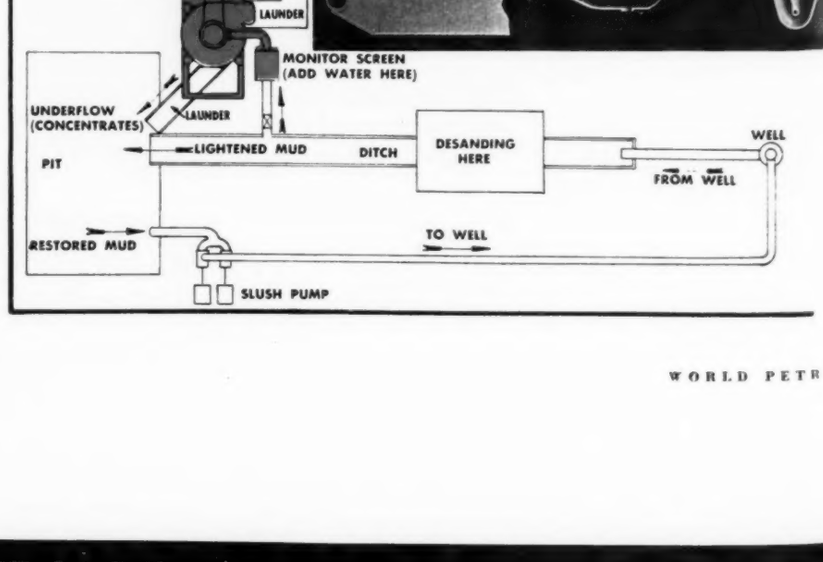
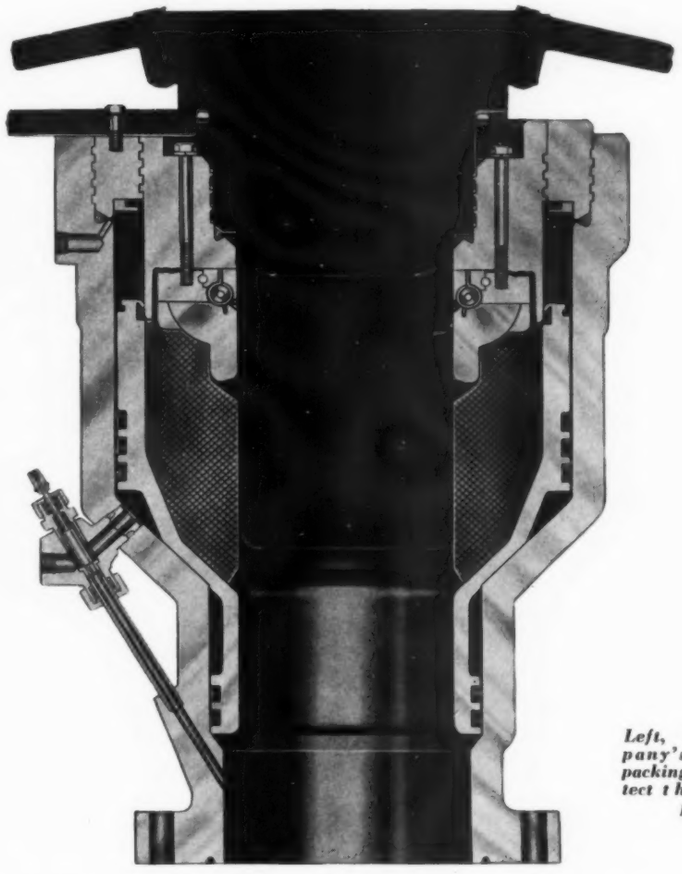




Cross sectional view of the Merco Centrifugal concentrator with diagram showing hook up of the concentrator.

HYDRIL COMPANY

AN AUXILIARY packing unit to protect the regular packer of the Hydril Type "R" Blowout Preventer from wear has been developed by the Hydril Company and is illustrated above. The main purpose of the auxiliary packing unit is to provide a wear-absorbing member which will reduce packer rubber replacement costs and conserve rubber. The Type "R" blowout preventer is ordinarily supplied with a rubber packing unit of approximately the same bore as its connecting flange. Rubber packing units with a smaller bore have heretofore been substituted for the regular packing unit when pipe of small size was in use. The new auxiliary packing unit allows changes in bore diameter between the maximum and minimum desired to be made by substituting auxiliary units of different size, the regular packing unit being used in all cases. The auxiliary unit takes all of the wear during operation of the blowout preventer and can be replaced with relatively small expense. The auxiliary packing unit is attached to the Type "R" blowout preventer by means of a semi-automatic locking device shown in the accompanying cross-section view. The locking device permits the removal and assembly of the auxiliary packing unit in the blowout preventer with minimum effort. When the drill string includes a member larger than the bore of the auxiliary packing unit, the unit may be unlocked from its place in the blowout preventer by pulling a single lever located on the derrick floor. The auxiliary unit then is lifted out of the blowout preventer by a large diameter tool. When the string is started in the hole again the auxiliary unit drops into place in the blowout preventer and locks automatically.



Left, Hydril Company's auxiliary packing unit to protect the regular packer.

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Merla Tool Corporation

A NEW PACKER developed by Merla Tool Corporation is known as Type CC and is illustrated on the right. It possesses special features needed in a well completion packer that is set through high pressure, long mandrel type well heads, which require longer travel of the packer in setting. Type CC packers have been run in some of the deepest wells in which packers have been set. The slotted neck provides for circulation above the packer but the tool can be furnished without slotted neck when requested. All parts, except tube, head assembly and cage being interchangeable with similar parts of Type C Merla packers. The CC packer has the lubricated metallic reinforced packing sleeve that is guaranteed not to stick to casing. This sleeve is so designed as to prevent its being stripped or torn off while running or pulling. Five dovetail slips are provided to insure an even distribution of increased area against the wall of the casing. The slips being dovetailed to the cone forces them to retract when packer is pulled. It is impossible to foul the valve as it is a sleeve type and is sealed off as the tube slides through the packing in the head assembly. Type CC is also available with solid tube (no slots) which makes it valveless.

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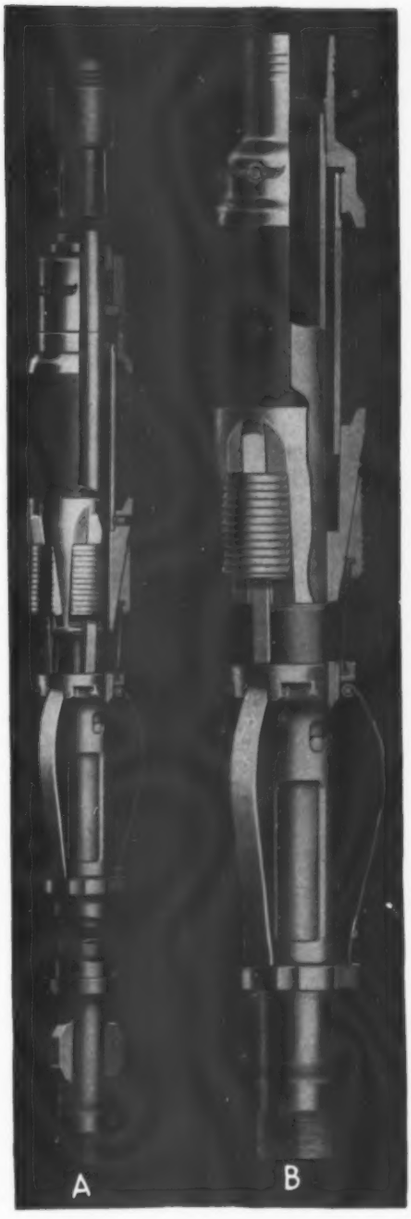
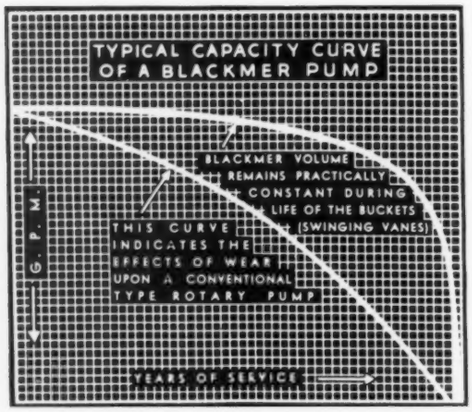
Merla Tool Corporation's Type CC packer.

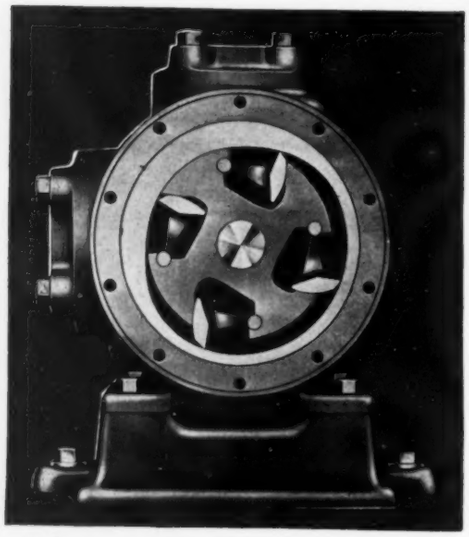


Blackmer Rotary Pump

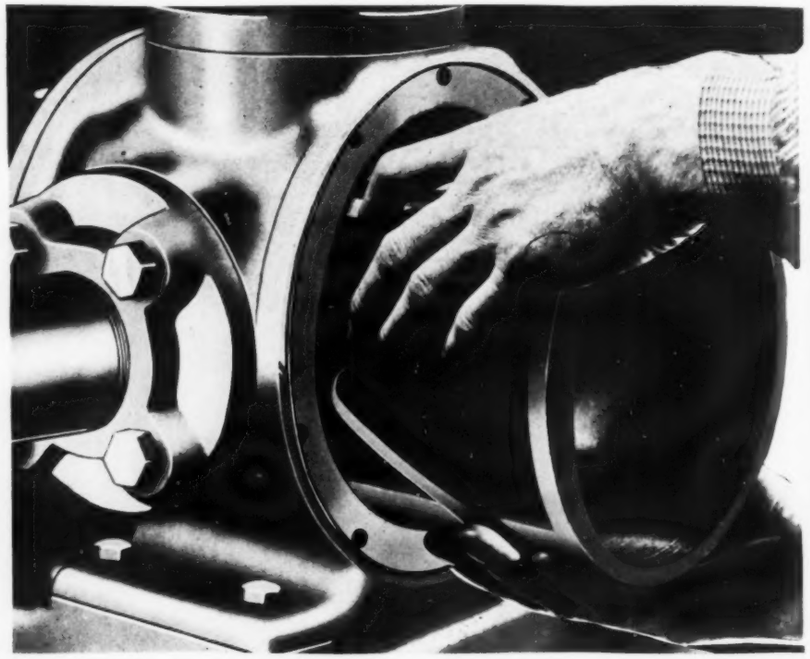
A NEW vertically mounted rotary pump has just been put into production at the plant of the Blackmer Pump Company, details of which are illustrated on this page. This new pump has the typical Blackmer "Bucket Design" (swinging vane) principle and has a capacity of 150 g.p.m. at a pressure of 100 lbs. per sq. in. and is powered by a 15 hp. gearhead motor—300 r.p.m. on the pump shaft. An accompanying curve shows one important characteristic of a Blackmer pump. Due to the bucket design there is practically no loss of volumetric efficiency, due to wear. Wear on the working parts of this pump is confined to the tips of the buckets, which automatically swing out further as they wear, maintaining the same contact with the wall of the casing.

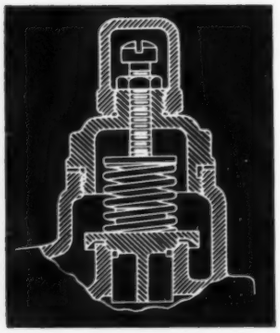


Below, open end view of Blackmer rotary pump showing the buckets.



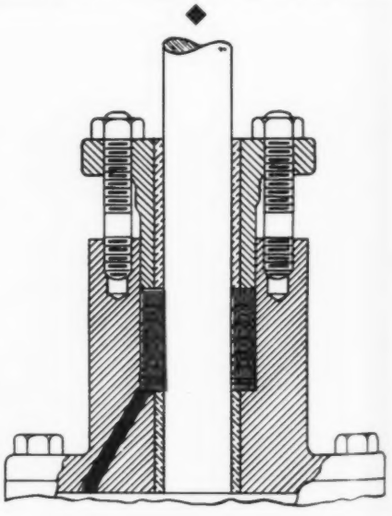
A diagram of operating cycle is reproduced at the bottom of this page. In the first step the bucket "A" has passed the sealing-point between the suction and discharge ports. As it moves on past the suction port it rides lightly against the casing wall, indicated by the black line. In the second step bucket "A" reaches the edge of the suction port two actions are taking place: liquid is pushed ahead of it and liquid is pulled behind it, through the powerful suction created. Suction is indicated by light red; pressure, or pushing action by solid red. In the third step, the action of two buckets must be considered. "A" has moved to a point just past the edge of the discharge port, completing the pushing cycle and releasing the pressure from Bucket "B" into the line. Bucket "B" has passed the suction port and is pushing the liquid. In the last step Bucket "A" is passing the discharge port. Note that, due to the cam bore of the casing wall, it has moved back into the recess of the rotor, displacing the greatest possible volume of liquid into the line.



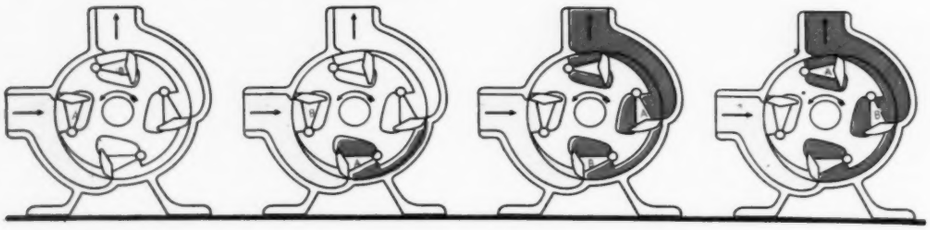


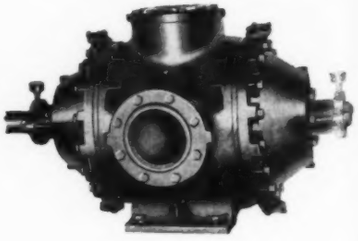
Above, removing the liner from a Blackmer pump.

Left, detail of a relief valve on a Blackmer rotary pump: Right, detail of bearing and gland construction.



Below left, cycle of operations in Blackmer pump: Below right, an exterior view of the Blackmer pump.

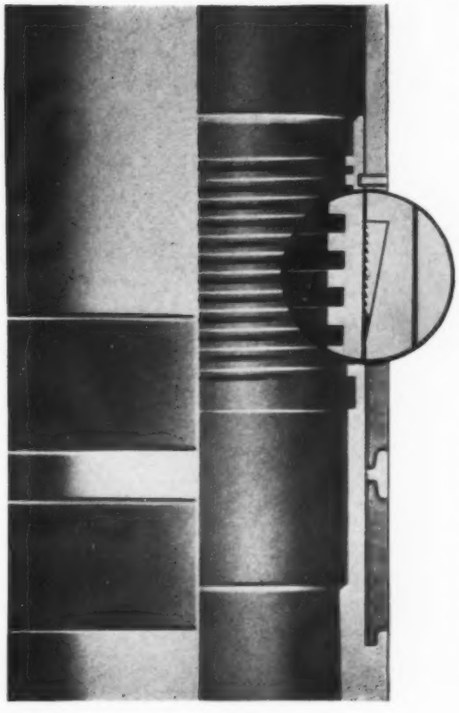




Security Engineering Co.

FOR sealing off unwanted perforations, changing gas/oil ratios, repairing collapsed or leaky casing, Security Engineering Co. has developed scabbing sleeves, one of which is illustrated below. The Security scabbing assembly is safe, efficient and easy to set, requiring only one trip into the hole to form a permanent liquid seal top and bottom, and effectively blank off the perforated or damaged portion of the casing. And once set, any tool capable of being run through the scabbing sleeve can also be run through the adapter and liner hanger, for the ID of the assembly is uniform throughout, with no restricting bottlenecks. The entire assembly is run in the hole on a Security left hand releasing tool having the delayed action device. When the desired point is reached, slips on the bottom packer are set in the usual way simply by rotating the run-in string to unlock the slips and then setting weight down to expand the lower packing elements. To set the top packing the run-in string is unscrewed from the scabbing assembly, lifted a short distance to allow the lugs on the delayed action device to expand above the top packer and then again lowered against the assembly. This action expands the top packing element and sets the packer lock slip. The separate expansion of both top and bottom packers thus obtained provides positive control of each pack-off, insuring a fluid-tight seal. When the top packing element is expanded, the small slip on the Packer Lock Slip, separately illustrated at the bottom of this page, travels down with the setting sleeve. But the instant that downward pressure is released and the compressed packing begins to force the sleeve back to original position, the lock slip wedges against the tapered groove, preventing any further upward movement and thus permanently locking the packing in expanded position.

Above, Security Engineering Company's scabbing sleeve assembly requiring only one trip into the hole to form a permanent fluid seal. Right, in the circle may be seen the packer lock slip for the scabbing sleeve assembly.



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Peerless Pumps

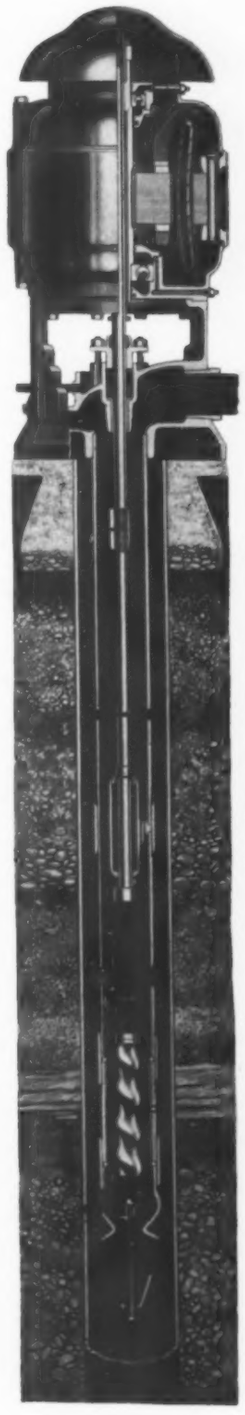
PEERLESS PUMP DIVISION of the Food Machinery Corp. has developed a small pump designed to handle 500 to 3500 gal. per hour. The pump illustrated below is based on the principle of squeezing the fluid upwards. The pump consists of a stator, a rotor both of helical form, and a drive shaft. The rotor rolls on the inner surface of the stator squeezing fluid ahead of the rolling action.

◆

Electric drive on the Peerless pump uses conventional vertical hollow shaft single or three phase motor. The line shaft need only be initially adjusted which can be done by means of a nut at the top of the motor.

The column of the Peerless pump consists of heavy standard pipe and straight threaded couplings. Fluted rubber bearings starting at five feet below the the pump head are spaced at ten foot intervals down to the lowermost bearing five feet above the bowl unit.

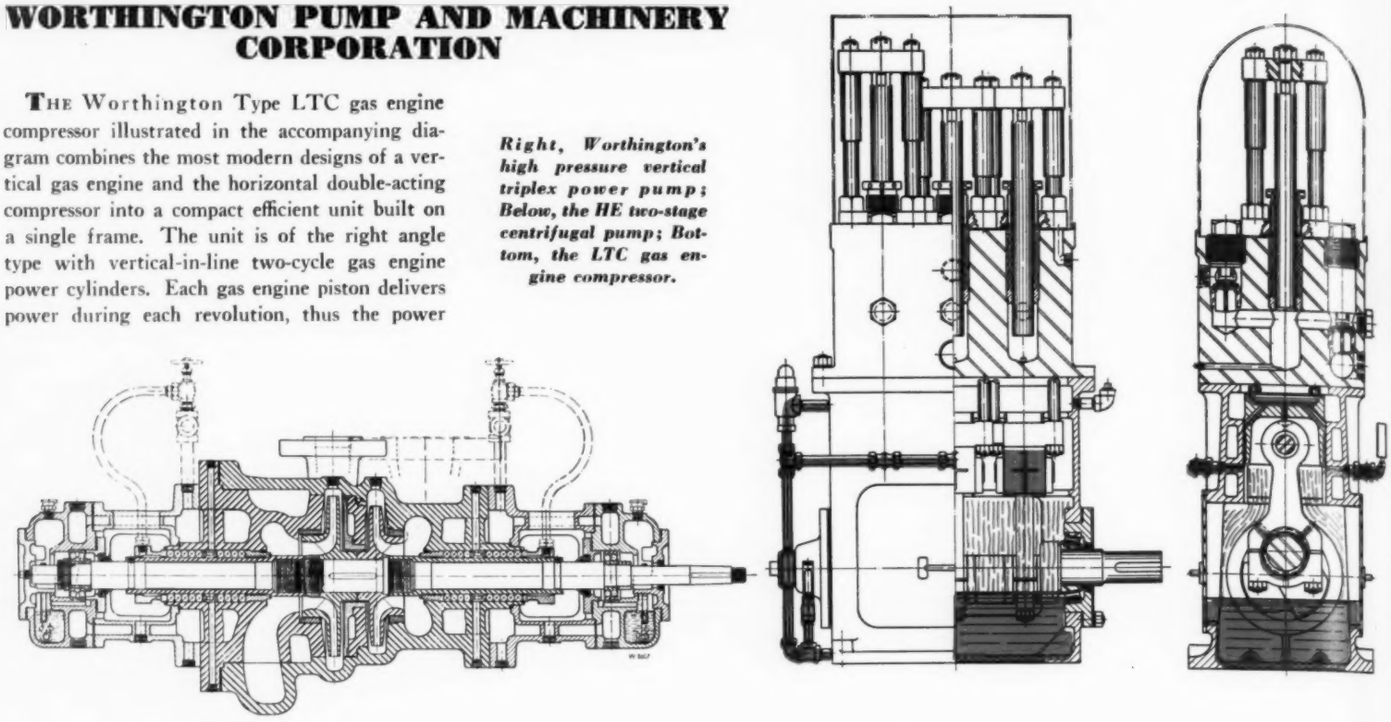
The stator on the Peerless pump is constructed of cutless rubber; while grit may become temporarily depressed in the rubber when the rolling action of the rotor passes over it, the grit is washed away by passage of the fluid.

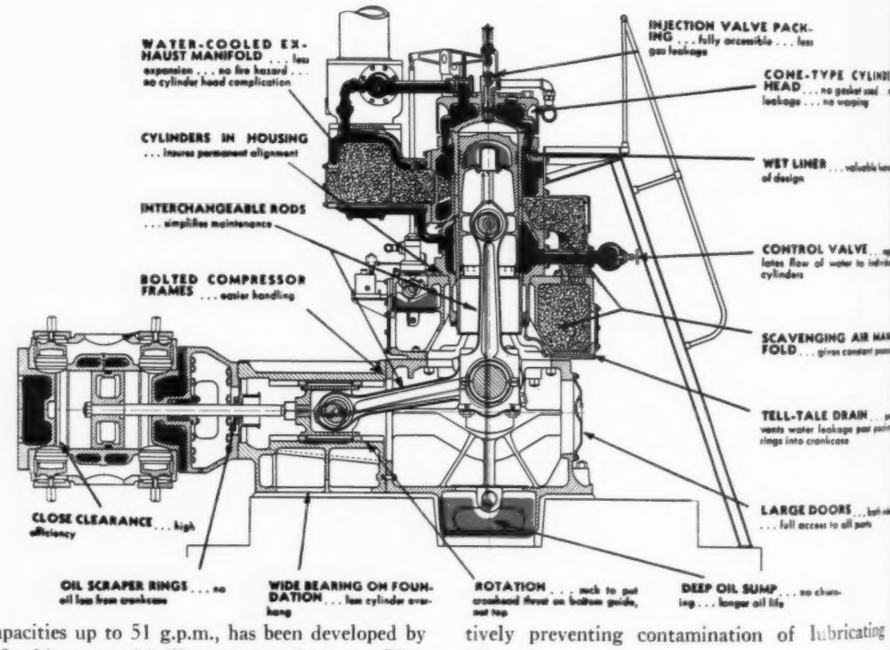


WORTHINGTON PUMP AND MACHINERY CORPORATION

THE Worthington Type LTC gas engine compressor illustrated in the accompanying diagram combines the most modern designs of a vertical gas engine and the horizontal double-acting compressor into a compact efficient unit built on a single frame. The unit is of the right angle type with vertical-in-line two-cycle gas engine power cylinders. Each gas engine piston delivers power during each revolution, thus the power impulses on multi-cylinder engine overlapping each other. As the accompanying illustration shows, the burnt gases are ejected as the piston uncovers the exhaust port, at the same time that fresh scavenging air under slight pressure is admitted from the opposite side of the cylinder, thus insuring thorough expulsion of exhaust gases. Fuel gas is injected into the cylinder under pressure on each upward stroke. Scavenging air is supplied by a separate scavenging compressor at the end of the unit. The power cylinders are all of the straight vertical-in-line type, each power cylinder delivering 125 b.hp. The engine is built with as few as three and as many as eight power cylinders. Therefore, units of 375-500-625-750-875 and 1,000 b.hp. are available. The power cylinders are thoroughly water cooled to carry away excess temperatures. Not only are the cylinders and the cylinder heads efficiently water cooled, but a system of oil cooling of the pistons is provided, thus carrying away the excessive heat normally generated at that point. The crankshaft is a heavy duty single piece steel forging, heat treated for strength and hardness, ground and polished. Shaft has drilled oil passages for force feed lubrication of the entire running gear. The main bearings are unusually large, centrifugally babbitted and interchangeable. The shells are held in place by flanges and by a four-bolted cap. Connecting rods are interchangeable between gas engine and compressor. Heat treated steel forgings are used with high grade bronze bushings for the wrist pin, and centrifugally cast babbitted interchangeable bearings for the crank pin. All bearings are force feed lubricated.

Right, Worthington's high pressure vertical triplex power pump; Below, the HE two-stage centrifugal pump; Bottom, the LTC gas engine compressor.





A new high pressure vertical triplex power pump in eight sizes, for pressure up to 9,800 lbs. and capacities up to 51 g.p.m., has been developed by Worthington and is illustrated on this page. This pump is of the vertical triplex single acting plunger type and particularly suited to applications where small capacities and high pressures are required in oil refineries on special process work. The pump has no gears and is especially designed for use with built-in gear head motors, although it can be arranged for V-belt drive. One of the important features of its construction is that its plungers are outboard and there is a dry joint between the liquid cylinder and power frame, thus eliminating the possibility of leakage of the liquid pumped into the crankcase, effectively preventing contamination of lubricating oil.

Worthington has developed two-stage, single suction, vertically split case, refinery type pumps to augment its complete line of single stage pumps. The new Type HE pumps are available for capacities from 120 g.p.m. to 700 g.p.m., against heads ranging up to 1,500 ft. The pumps are arranged for center-line support, with or without water cooled pedestals, and can be readily dismantled without disturbing piping connections or the driver.

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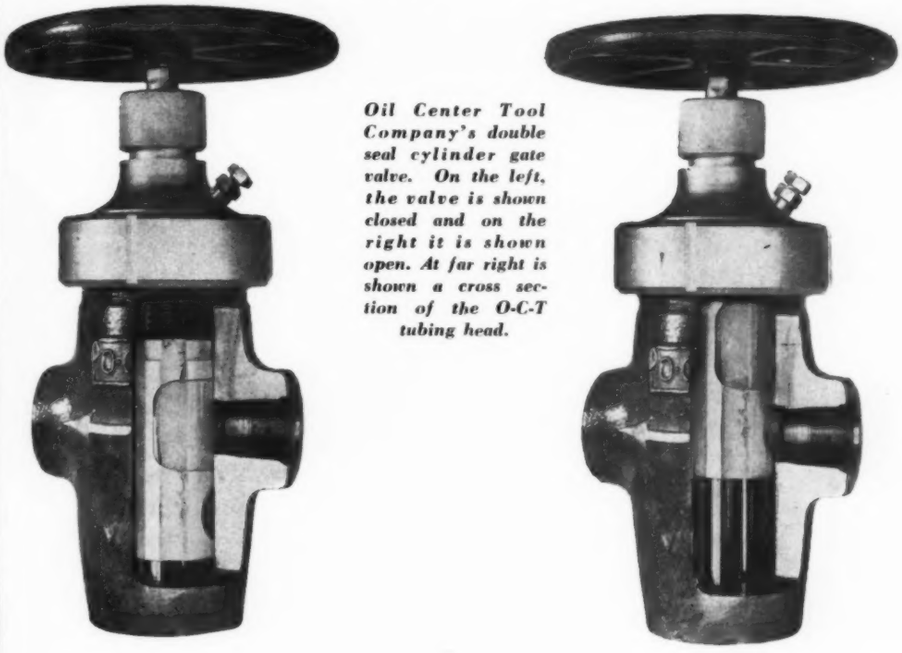
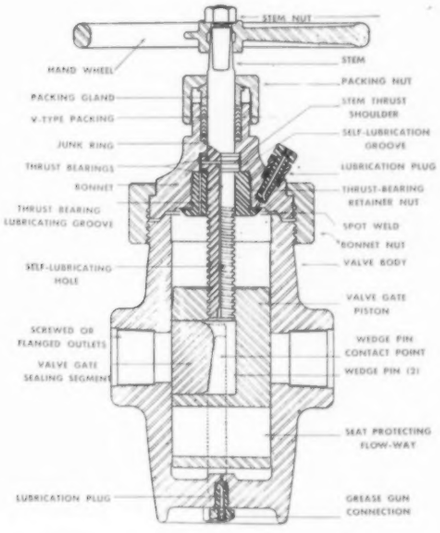
OIL CENTER TOOL COMPANY

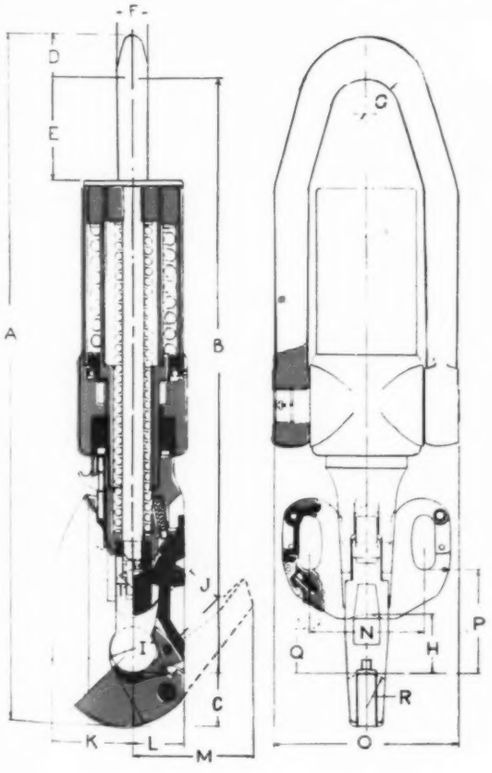
A CROSS SECTION view of the O-C-T T-20-F-1 Tubing head is illustrated herewith. This head is used extensively in fields where completion method requires lowering the tubing hanger below the point of suspension for the purpose of washing the well to bottom and collapsing the packer before hanging the tubing. Note that the hanger seats may be retracted to permit lowering the hanger through the head and then may be screwed in to engage the hanger. Note also that the resilient packing rings which are provided on the hanger are compressed by the weight of the tubing string to effect a seal. The O-C-T Double Seal Cylinder Gate Valve employs a unique means of sealing and lubrication. As shown in the cross-section drawing, the valve employs piston type gate which travels vertically in a cylinder . . . the valve body. A flow way, or conduit, is drilled horizontally through the lower part of the gate piston, so that when the valve is in open position the flow way is lifted opposite the flow outlets. This feature prevents the accumulation of foreign matter in the valve body. In open position, the valve seats are protected against the cutting action of abrasive fluid.

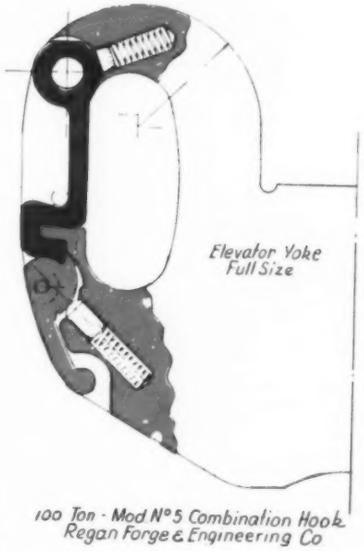


Oil Center Tool Company's double seal cylinder gate valve. On the left, the valve is shown closed and on the right it is shown open. At far right is shown a cross section of the O-C-T tubing head.



REGAN FORGE AND ENGINEERING COMPANY





100 Ton - Mod N°5 Combination Hook
Regan Forge & Engineering Co

A NEW HOOK known as Model 5 for 100-200- and 300-ton capacities has been developed by Regan Forge & Engineering Company, and is illustrated on the left. It embodies two separate load-carrying elements. The large hook carries the swivel bail, while the two smaller hook elements, formed by the cross yoke, carry the elevator links. The cross yoke is slidably mounted within an aperature of the main hook. It is supported by a large capacity spring with an adjustable means for regulating the lifting power necessary to handle the various sizes of drill pipe, either in stands of fourbles or trebles. The spring, acting only upon the double hook member, is not under stress during drilling operations. The main hook is independently supported by a heavy spring in conjunction with an anti-friction bearing. The spring is installed with a predetermined tension so that when lift is applied it protects the threaded connections of the kelly and drill pipe in breaking out and making up. The hook is provided with an anti-swiveling safety lock which is, in turn, locked in position and can only be opened by manual operation. The hook can be locked in four positions. When the latch on the large lower hook is in open position it hangs at a convenient angle and readily engages the swivel bail, the weight of which automatically closes and locks the latch in the closed position. The hook is slightly overbalanced on the back side, to facilitate the engagement of the elevators.

STRATCO ALKYLATION CONTACTOR

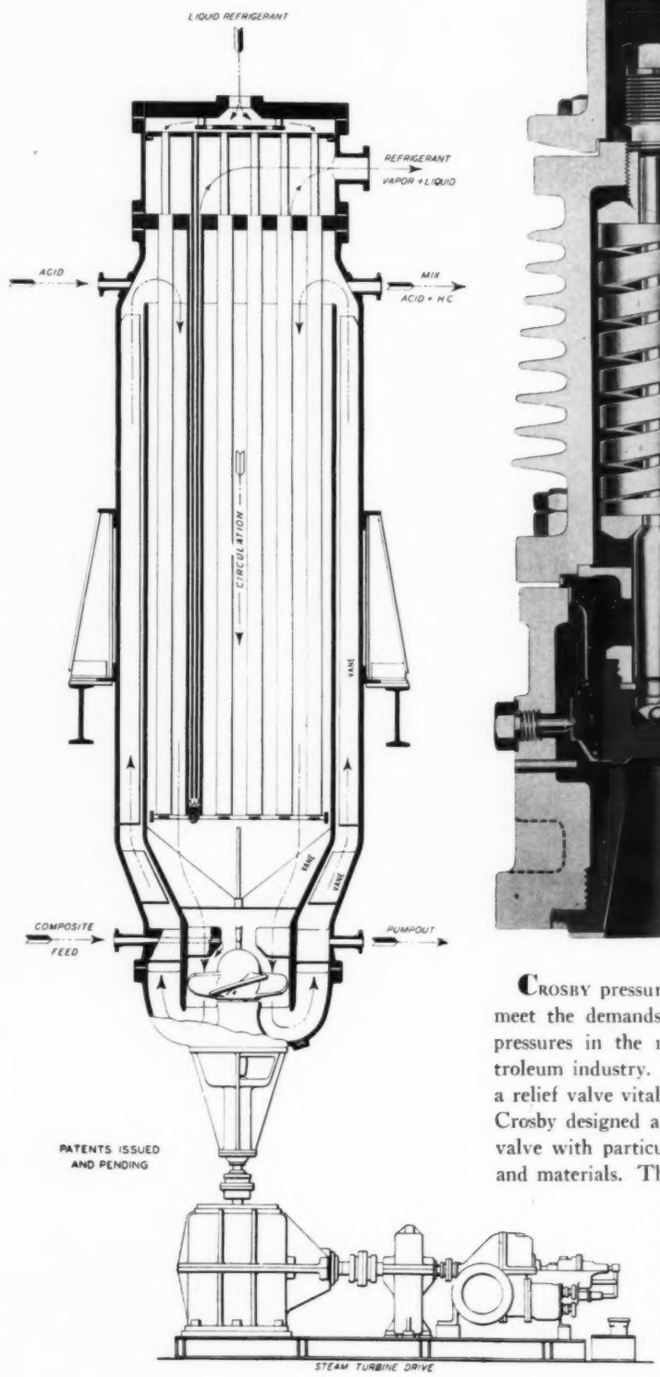
THE Stratco Alkylation Contactor has been especially developed for establishing proper conditions of mixing, temperature, and isobutane-olefin ratio in any alkylation system. It has been widely adopted as the "heart" of many alkylation plants both operating and building.

The cross sectional drawing shows the general construction and the arrows indicate flow within the machine. Circulation rate established by the impeller is 45,000 to 50,000 gal. per minute. Residence time within the machine for the hydrocarbons and acid catalyst is sufficient for completing the alkylation reaction. The machine is operated liquid full under pressure higher than the vapor pressure of the hydrocarbon feed at the reaction temperature. The mix leaving the contactor to the settler shows substantially no olefin content and, since the mix leaving is of the same composition as the circulation down through the tube bundle to the impeller, it is evident that the circulating stream to the impeller contains substantially no olefin. The excess isobutane not consumed in the reaction does exist in the circulating stream entering the impeller.

As an example of the method by which the machine builds up dynamically a large isobutane-olefin ratio at the point of contact, consider the following: A composite hydrocarbon feed is employed containing sufficient isobutane to result after alkylation in a hydrocarbon effluent containing, say, 65 percent isobutane. The acid recycled to the contactor is sufficient to make a mixture containing 60 percent acid and 40 percent hydrocarbon. The circulation through the impeller is 50,000 gal. per minute. The isobutane content of the circulated stream entering the impeller is then 50,000 by .40 by .65, or 13,000 gal. per minute.

The composite hydrocarbon feed containing the olefin is introduced immediately above the hub of the impeller where it meets the large circulating stream containing the 13,000 gal. per minute of isobutane. The two streams pass through the impeller and shear vanes together, where they are intimately mixed. If the olefin content of the hydrocarbon feed amounts to, say, 10 gal. per minute, then the volume ratio of isobutane to olefin at the point of dispersion and mixing is 1,300 to 1. This condition favors the manufacture of an alkylate containing a high percentage of high octane aviation fraction. It is well known in the art of alkylation that, for any given set of other conditions, the higher the isobutane-olefin ratio, the better the quality of the alkylate produced.

The high circulation rate established in the contactor also provides high heat transfer rates on the refrigerating tube bundle for removing the exothermic heat of reaction and mechanical heat. Liquid refrigerant is made available to the inside tubes of the double lance-type tube bundle and circulation of refrigerant is self-established by the thermo-syphon or gas lift effect of the vaporized refrigerant rising in the outer tubes. Any refrigerant may be used, such as, ammonia, propane, or isobutane. In cases where refrigeration is not required cooling may be accomplished by pumping water through the tube bundle. Temperature of the entire reaction mass can be maintained to within limits of less than one degree F. The system is covered by patents issued and pending.



STRATCO ALKYLATION CONTACTOR

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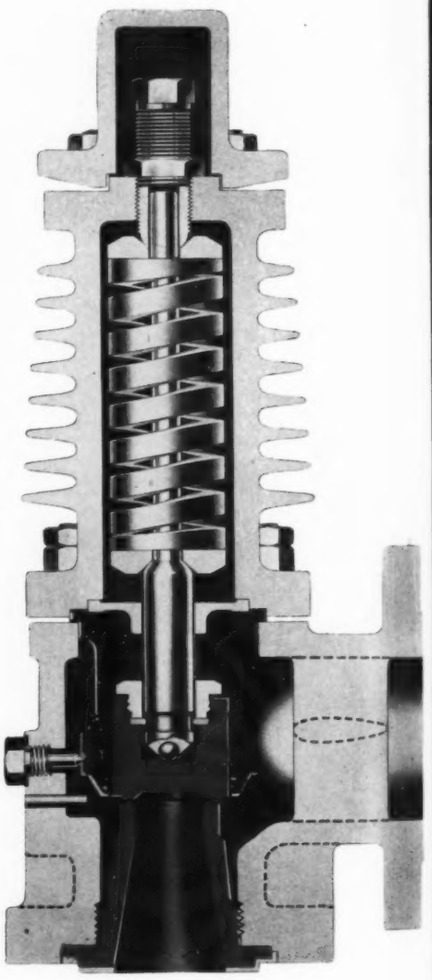
Crosby Steam Gage and Valve Company



CROSBY pressure relief valves are designed to meet the demands for higher temperatures and pressures in the rapid advancement of the petroleum industry. Recognizing that the seats of a relief valve vitally affect its operation and life, Crosby designed and developed the nozzle relief valve with particular emphasis on seat contours and materials. The seat design of a relief valve must be such that it will render continued leak-free service under all conditions and at the same time be sufficiently simple in design to facilitate easy maintenance, providing many years of reliable service. The advantages of the flat seat design on both the nozzle and

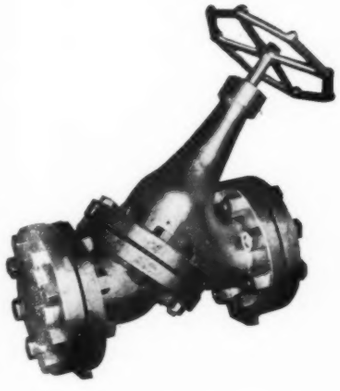
disc over other forms of seat contours recommends it for particular attention. In the Crosby flat seat construction the pressure forces tending to open the valve have only the spring load to overcome without the additional seat friction which would accompany any other type of seat construction. This assures a definite relieving pressure for the valve and eliminates leakage caused by scraping and gouging of one seat against the other. When the valve opens the flow across the seats will be in a radial direction, parallel to the seal; thus the cutting action on the seats of the discharging media is negligible. A minimum amount of lift is required to allow the valve to relieve its full capacity, thereby reducing the spring stresses and possible spring failure. When the valve is in the closed position any variation of expansion between the seats, or egg-shaping, would not affect the tightness of the valve. One of the most important features of the flat seal relief valve design is the ease of maintenance.

◆

Hunt Tool Company

A NEW series of heavy duty high pressure valves has been developed by Hunt Tool Company: One of these all steel valves is illustrated below. This new series of line valves is of simple design, and features a reversible disc and seat of stainless steel. The seat is held in place by two standard API rings. These rings, being of lower Brinnell hardness than the disc, take the wear, assuring positive seal as the seat and disc wear. The same disc and seat will fit any of the various valves of the same size, whether screwed or flanged. The valve is manufactured in both the 2- and 4-inch range, 4,000- and 6,000-pound test, screwed or flanged. Due to the compact design of this type valve, it eliminates unnecessary connections and reduces space requirements to a minimum. Construction is such that it is unnecessary to remove the valve from the line to reverse or renew the disc or valve. It is only necessary to remove the eight flange bolts, and raise the bonnet sufficiently to clear the seat.

Hunt Tool Company's all steel, heavy duty line valve.



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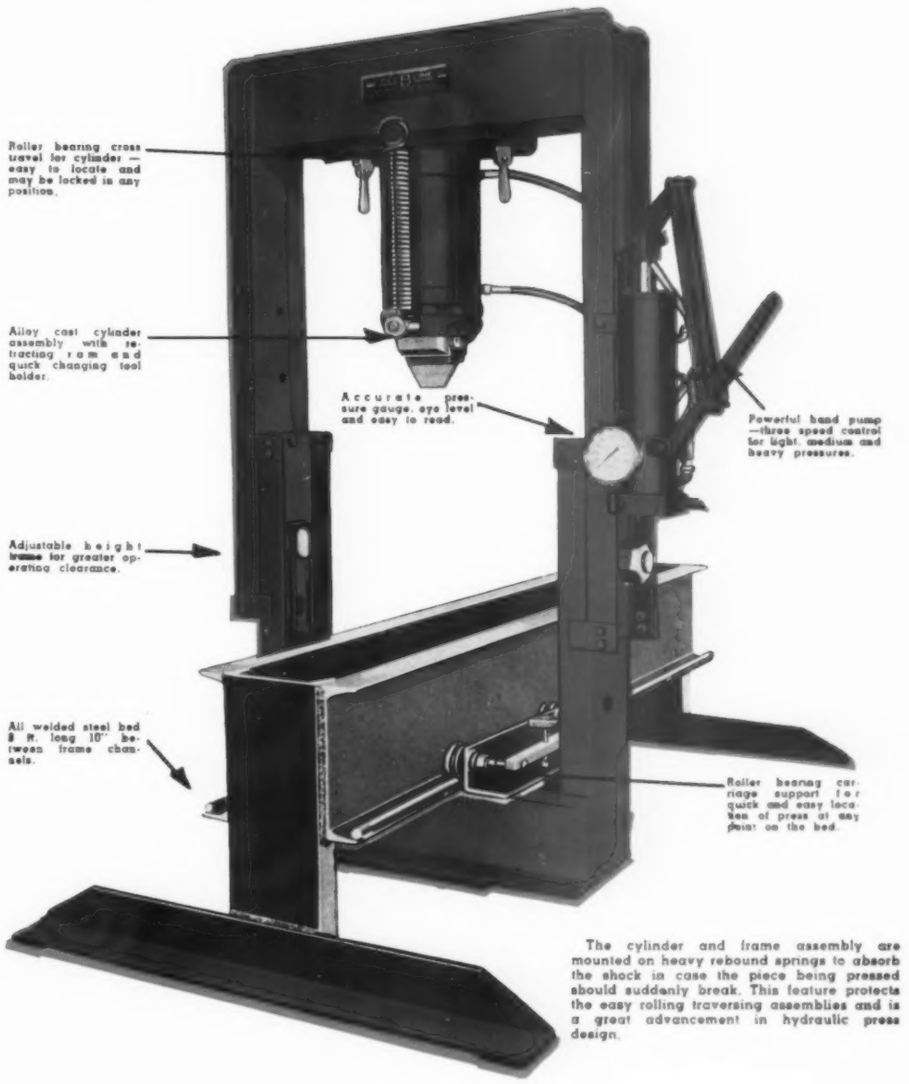
Bee-Line Company

RECLAMATION and conservation of bent, kinked, and distorted oil pipes up to sizes 14 O.D. by .500 wall is now made possible with a new 125 ton hydraulic press straightening and special tool equipment designed and manufactured by The Bee-Line Company. In view of strict limitations on purchase of new steel, this machine should be of great interest to the oil industry. The press, illustrated above, is mounted on a movable roller bearing carriage which permits application of pressure at any point in a 84 in. by 34 in. bed. The jack carriage can be raised or lowered 16 in. with a minimum space between the ram and the bed of two inches and a maximum space of 28 in. The ram travel is 10 in. The jack features three speeds—high, medium and low. Overall dimensions of the complete press are: Length 8 ft., width 4 ft. 8 inches, weight 4,000 lbs. Conservative estimates have been made that two men can reclaim enough casing within a few weeks time to pay for the initial investment on the press.

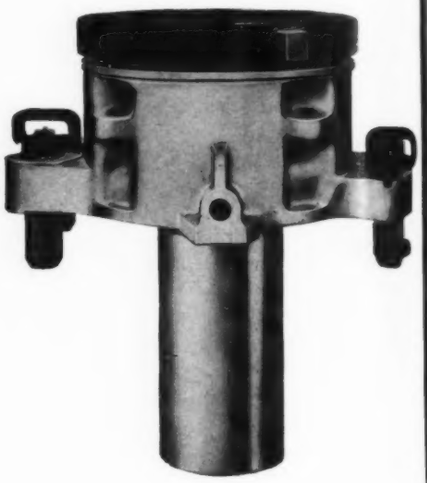

Roller bearing cross travel for cylinder — easy to locate and may be locked in any position.
Alloy cast cylinder assembly with retracting ram and quick changing tool holder.
Accurate pressure gauge, eye level and easy to read.
Powerful hand pump —three speed control for light, medium and heavy pressures.
Adjustable height frame for greater operating clearance.
All welded steel bed 8 ft. long 10" between frame channels.
Roller bearing carriage support for quick and easy location of press at any point on the bed.
The cylinder and frame assembly are mounted on heavy rebound springs to absorb the shock in case the piece being pressed should suddenly break. This feature protects the easy rolling traversing assemblies and is a great advancement in hydraulic press design.

The Bee-Line Company's 125 ton press for straightening bent oil pipe.

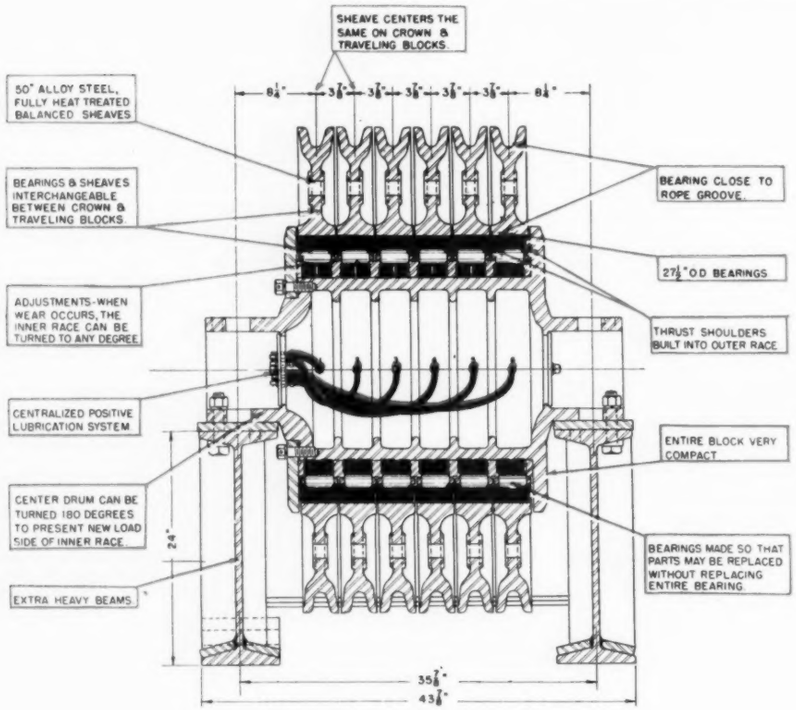
EMSCO DERRICK AND EQUIPMENT COMPANY

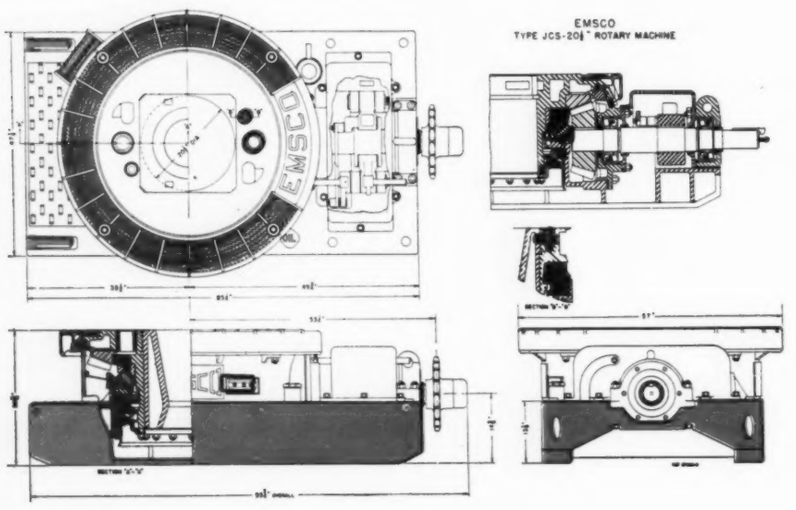
THE Emsco Series M-50 crown and traveling blocks illustrated on this page are designed for deep well drilling. The sheaves are 50 in. alloy steel fully heat treated and balanced on a 19 in. center drum with 27½ in. O.D. bearings which are close to the rope groove to prevent tilting. Bearings and sheaves are interchangeable between crown and traveling blocks and extremely short and narrow. Side plates of traveling block are rolled steel plate. The inner race of the bearing can be turned to any degree presenting a new load side. Both blocks have a centralized positive lubrication system.

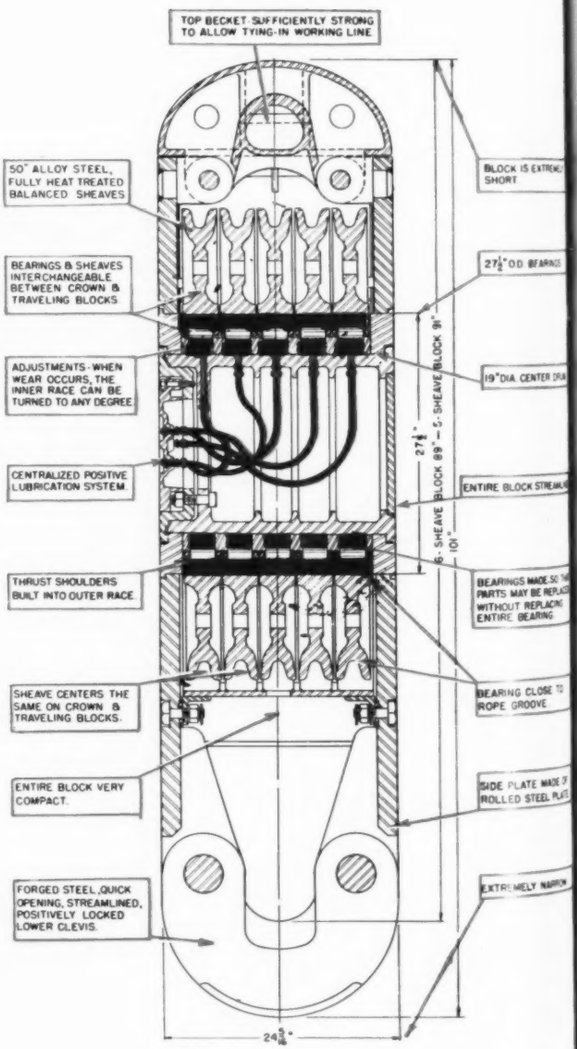
The Emsco Type JCS-20½ in. rotary machine illustrated at the bottom of this page was designed to eliminate racking and backlash when the drill stem bushing is driven by the master bushing, the master bushing in turn being driven by the square in the table top. Though the Type JCS-20½ in. rotary machine may be used with either pin type or conventional drill stem bushings, the pin type bushings are recommended. The pin type drill stem bushings equipped with either roller assemblies or liner type inserts, are driven by the table by two pins which are a part of the bushing. The driving holes in the table top are equipped with rubber cushioned, steel protected inserts, which materially cushions the load, eliminating destructive forces from the table, the bushings and drill pipe. There is a close fit between these driving bushings, which are pressed into the holes in the table top, and the driving pins of the drill stem bushings. There is no contact between the drill stem bushing and

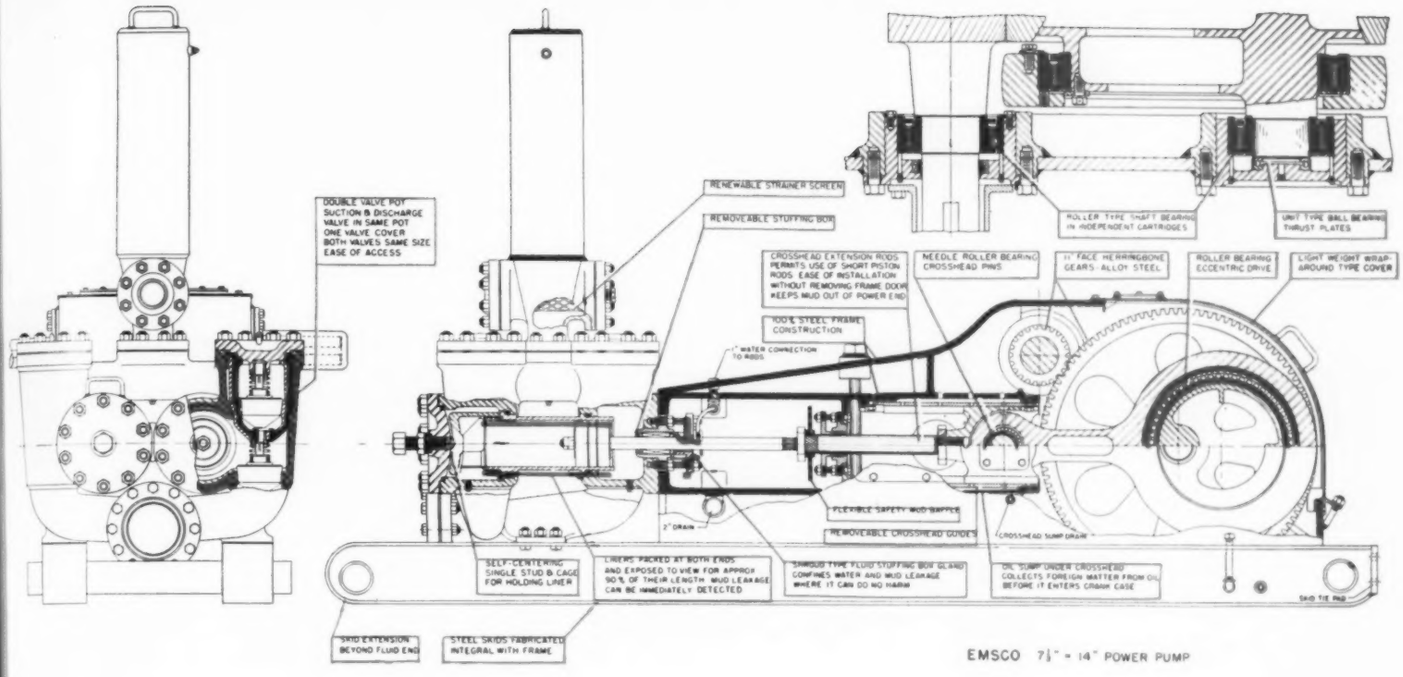


Below, the Emsco series M-50 crown and travelling block and the JCS-20 ½ in. rotary machine. Right, the Emsco pin type drill stem bushings.


SHEAVE CENTERS THE SAME ON CROWN & TRAVELING BLOCKS.
50" ALLOY STEEL, FULLY HEAT TREATED BALANCED SHEAVES.
BEARINGS & SHEAVES INTERCHANGEABLE BETWEEN CROWN & TRAVELING BLOCKS.
ADJUSTMENTS-WHEN WEAR OCCURS, THE INNER RACE CAN BE TURNED TO ANY DEGREE.
CENTRALIZED POSITIVE LUBRICATION SYSTEM.
CENTER DRUM CAN BE TURNED 180 DEGREES TO PRESENT NEW LOAD SIDE OF INNER RACE.
EXTRA HEAVY BEAMS.
BEARING CLOSE TO ROPE GROOVE.
27½" OD BEARINGS.
THRUST SHOULDERS BUILT INTO OUTER RACE.
ENTIRE BLOCK VERY COMPACT.
BEARINGS MADE SO THAT PARTS MAY BE REPLACED WITHOUT REPLACING ENTIRE BEARING.
24"
35½"
43⅛"




TOP BECKET SUFFICIENTLY STRONG TO ALLOW TYING-IN WORKING LINE.
50" ALLOY STEEL, FULLY HEAT TREATED BALANCED SHEAVES.
BEARINGS & SHEAVES INTERCHANGEABLE BETWEEN CROWN & TRAVELING BLOCKS.
ADJUSTMENTS-WHEN WEAR OCCURS, THE INNER RACE CAN BE TURNED TO ANY DEGREE.
CENTRALIZED POSITIVE LUBRICATION SYSTEM.
THRUST SHOULDERS BUILT INTO OUTER RACE.
SHEAVE CENTERS THE SAME ON CROWN & TRAVELING BLOCKS.
ENTIRE BLOCK VERY COMPACT.
FORGED STEEL, QUICK OPENING, STREAMLINED, POSITIVELY LOCKED LOWER CLEVIS.
BLOCK IS EXTREMELY SHORT
27½" OD BEARINGS
19" DIA CENTER DRUM
ENTIRE BLOCK STREAMLINED
BEARINGS MADE SO THAT PARTS MAY BE REPLACED WITHOUT REPLACING ENTIRE BEARING.
BEARING CLOSE TO ROPE GROOVE.
SIDE PLATE MADE OF ROLLED STEEL PLATE
EXTREMELY NARROW
6-SHEAVE BLOCK 89" — 5-SHEAVE BLOCK 81"
101"
27½"
24⅜"


DOUBLE VALVE POT SUCTION & DISCHARGE VALVE IN SAME POT ONE VALVE COVER BOTH VALVES SAME SIZE EASE OF ACCESS
RENEWABLE STRAINER SCREEN
REMOVEABLE STUFFING BOX
ROLLER TYPE SHAFT BEARING IN INDEPENDENT CARTRIDGES
UNIT TYPE BALL BEARING THRUST PLATES
CROSSHEAD EXTENSION RODS PERMITS USE OF SHORT PISTON RODS EASE OF INSTALLATION WITHOUT REMOVING FRAME DOOR KEEPS MUD OUT OF POWER END
NEEDLE ROLLER BEARING CROSSHEAD PINS
11° FACE HERRINGBONE GEARS ALLOY STEEL
ROLLER BEARING ECCENTRIC DRIVE
LIGHT WEIGHT WRAP-AROUND TYPE COVER
100% STEEL FRAME CONSTRUCTION
1" WATER CONNECTION TO RODS
FLEXIBLE SAFETY MUD BAFFLE
2" DRAIN
REMOVEABLE CROSSHEAD GUIDES
CROSSHEAD SUMP DRAIN
SELF-CENTERING SINGLE STUD & CAGE FOR HOLDING LINER
LINERS PACKED AT BOTH ENDS AND EXPOSED TO VIEW FOR APPROX 90% OF THEIR LENGTH MUD LEAKAGE CAN BE IMMEDIATELY DETECTED
SINGLE TYPE FLUID STUFFING BOX GLAND CONFINES WATER AND MUD LEAKAGE WHERE IT CAN DO NO HARM
OIL SUMP UNDER CROSSHEAD COLLECTS FOREIGN MATTER FROM OIL BEFORE IT ENTERS CRANK CASE
SKID TIE ROD
SKID EXTENSION BEYOND FLUID END
STEEL SKIDS FABRICATED INTEGRAL WITH FRAME

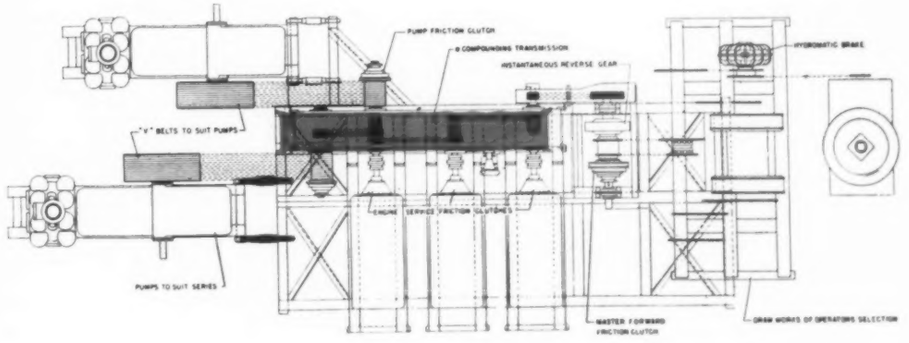
EMSCO 7½" × 14" POWER PUMP

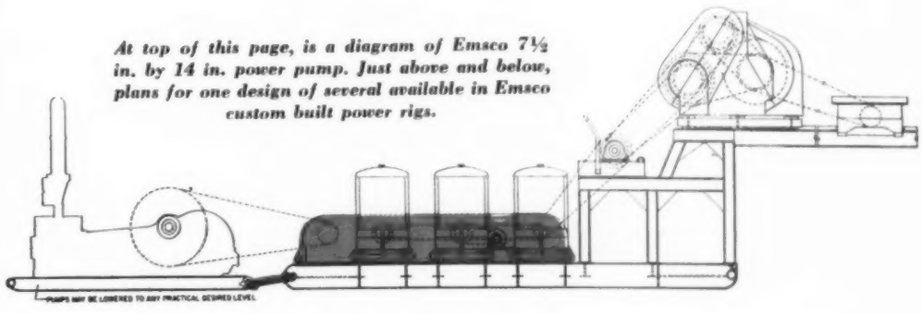
the master bushing which is left in the rotary machine while drilling.

The pin type drill stem bushings illustrated on the facing page is designed to take the Baash-Ross roller bearing assemblies. These drill stem bushings are equipped with a skirt which facilitates guiding the driving pins into the corresponding holes in the table top. Locks are provided for locking the bushings into the table. These locks are designed so that they are positively held in or out of position as desired. The roller assemblies are locked into position by a screw type lock collar which in turn is locked by a bolt so it cannot accidentally loosen. The entire assembly is extremely rigid and has enough weight so that all possibility of bouncing is eliminated. Provision is made in the design for the insertion of the Patterson-Ballagh kelly wiper. The Type "E" master bushing is used in connection with the above illustrated bushings and also with the type "E" drill stem bushing which is designed for using liners instead of the roller assemblies.

The Emsco 7½ by 14 in. power slush pumps illustrated herewith are of all-steel construction with fabricated power end and cast steel fluid end and were designed to serve two primary purposes, i. e. substantial reduction in weight and the strength and ruggedness of steel. A new departure in slush pump fluid end is presented in the use of four double-deck valve chambers instead of the conventional eight independent valve chambers. The discharge valve is mounted directly above the suction valve in a renewable bushing which is, in turn, held in place by a cage. The suction valve seat is placed directly in a bore in the valve chamber where the discharge valve seats in the aforementioned bushing. Both suction and discharge valves are of the same size. This construction reduces weight and facilitates removal of the valve and seats. It also reduces the number of bolted on valve covers from eight to four. The power end is fabricated from structural steel shapes and plates and cast alloy steel. Steel bearing housing castings are built into the side plates of the frame and a cast forward section containing the crosshead bores and general forward end portion is welded between the two side plates. A heavy steel plate forms the bottom of the forward section and also the bottom and end of the gear case, being welded between the two side plates. Another heavy plate forms the top and is likewise welded between the side plates.

Emsco custom built power units differ from Emsco's stock power rig in that the latter are built to a limited design and are quantity produced, while the custom built internal combustion rig can be varied in design to meet a variety of requirements in rig placement and engine selection. The particular model diagrammatically illustrated has two shafts, two engines and one





At top of this page, is a diagram of Emsco 7½ in. by 14 in. power pump. Just above and below, plans for one design of several available in Emsco custom built power rigs.

EMSCO Continued

pump drive. The master forward clutch and reverse may be seen mounted at half the elevation of the drawworks.

Emsco's new GT-42 hydraulic torque converter portable power rig is designed for depths to 6,000 ft.; the entire unit can be moved as a single package. There are six hoisting speeds and three rotary speeds. An outstanding feature of this rig is the hydraulic drive which consists of a Twin Disc A-16000 adjustable blade torque converter illustrated herewith, built into the drawworks. The inclusion of this converter in the drawworks has not incerased the size of the drawworks or materially changed the weight of the drawworks. The drawworks transmission has even been simplified. In pulling and running pipe, full torque may be applied with the smoothness of steam or direct electric power. Shock is eliminated and operations are speeded up. This is of particular advantage in fishing operations. In rotating maximum torque applied to the drill pipe is readily controlled by the driller. The speed of rotation slows down smoothly when the bit encounters changing hard formations, stickly drilling or sudden feed off—thus protecting the drill pipe. The adjustable blade feature of this converter gives extreme flexibility of operation. In an instance where two or more engines are compounded to drive the pumps and rotate the table, the rotating speed may be varied from zero to maximum while the engines are kept at full speed for pumping.

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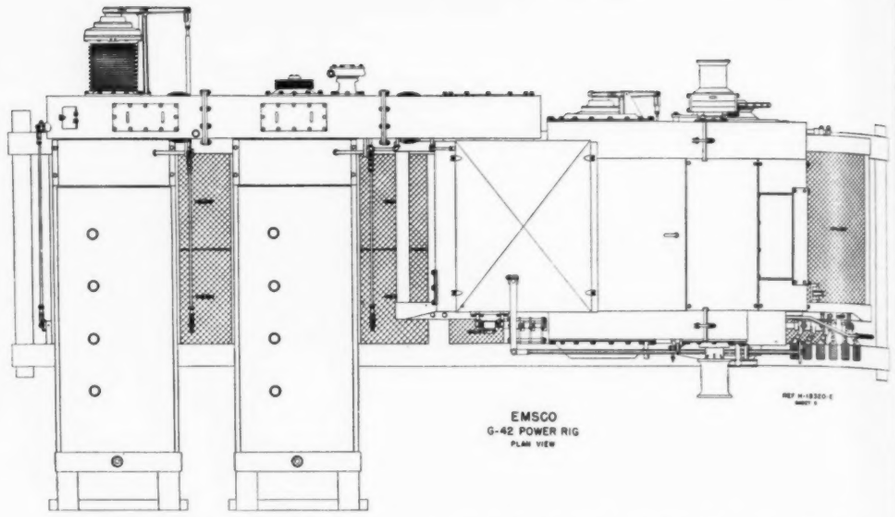

Emsco's new hydraulic torque converter on the GT-42 portable rig for depths to 6000 ft.

PORTABLE RIG COMPANY

AN IMPROVED heavy duty drilling rig capable of drilling to depths of 10,000 ft. or deeper is a recent development of the Portable Rig Company. An outstanding feature of this rig, known as Model DC-48, is the drum clutch illustrated herewith. Although designed for the deepest drilling the overall dimension of the complete drawworks with compound drive, three engines, pump drive and pump and special two level structure is only 27½ ft. wide by 41½ ft. from derrick floor to extreme end of pump skids. Illustrated herewith is a cross section through the drum clutch used in the Model DC-48 drawworks. The main drive is from the transmission shafts in the rear of the case to the triple sprocket shown. This clutch is mounted in the brake flange of the drum. High pressure oil from a control valve enters the packing gland (A), travels through the drilled drum shaft and enters the left side of the hydraulic clutch operating cylinder through radial holes (B). This high pressure oil is supplied by an over-capacity pump piped from the lubricating oil sump in the drawworks case, and is entirely separated from the low pressure drawworks lubricating oil pump. The piston in the hydraulic cylinder is indicated by the letters (C-C) on the outside diameter and (D-D) on the inside diameter. Low pressure lubricating oil is admitted to the system at (E), travels through the cored passages (F) and enters the cylinder at (G). It is applied to the right side of the piston at all times so that the effective pressure acting to engage the clutch is actually a differential pressure between the high pressure oil and oil at lubricating pressure. When the high pressure oil enters the cylinder, the piston moves to the right, carrying the driving pins (I) and the ring (J). The left cone (K) engages first and it with the assembly (N) and companion cone (L) is carried along the movement of the piston, so that engagement of right clutch (L) is only slightly delayed. By engaging the clutch gradually in this manner, the action is similar to that of the multiple disc type of friction clutch. The operating thrusts of the clutch are in balance at all times excepting the moment of starting contact of cone (K) and this slight off-balance is amply provided for in shaft to case bearing assembly.

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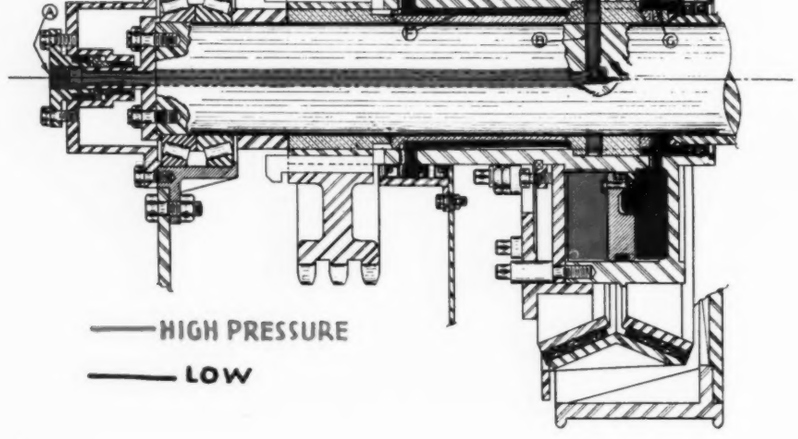

Drum clutch for Portable Rig Company's Model DC-48 rig: red represents high pressure oil flow and blue represents low pressure oil flow.

Babcock & Wilcox Company

THE Babcock and Wilcox integral furnace boiler, extends the application of the integral furnace boiler to installations of lower capacity fired by stokers or oil burners. The furnace, illustrated on the right, includes water-cooled construction in which the front wall, as well as the rear or bridge wall, side walls, and roof are all water-cooled. The primary combustion zone is followed by an open pass, making use of a principle of combustion whereby the gases are thoroughly mixed while at high temperatures, thereby aiding in efficient and smokeless combustion. Cyclone steam separators provide dry steam at high boiler-water concentrations, independently of wide variations in water level, increase circulation by eliminating steam from the down-flow water and provide a more nearly correct water-level indication. The large amount of water cooling surface in the furnace permits wide variation in the grade of coal that can be burned successfully. Oil burners can be inserted through the front wall at small cost for brickwork changes. Efficient heat absorption results from the cross flow of gases over the heating surfaces. The furnace design permits operation with lower excess air (high CO_2), resulting in further increase in efficiency.

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Babcock and Wilcox integral furnace boiler arranged for firing with single-retort side dump underfeed stoker.

John Zink Company

JOHN ZINK has developed a rotor-gas burner designed to use oil or gas or a combination of both and especially adapted to the refining industry. The rotor-gas burner is an improved gas-actuated fan type burner. Gas flowing into the burner drives a fan which delivers air for combustion. A proportioning effect is thus obtained in that the amount of air delivered by the fan is governed by the amount of gas flowing through the burner. Bearings are in a cold zone and are shielded from radiant heat. No water-cooling is necessary for the bearings even in the most severe service. Bearings are standard friction-free flange type pillow blocks which are readily obtainable. The burner is equipped with eight large gas orifices which will not stop up. The rugged construction of the burner makes extremely close machining tolerances unnecessary. Design of the burner is such that if for any reason the fan should become inoperative the burner will operate equally well in natural draft without the fan.

There are eight stationary gas jets with 1/8 in. or more diameter parts. The small diameter of the rotor or power wheel eliminates the chance of unbalance due to deposits of sulphur, salt or carbon. Stuffing boxes have been eliminated. The burner is provided with a hollow center shaft permitting the installation of an oil burner through the center. When oil is being burned steam is used for motive power and all but two jets are shut off.

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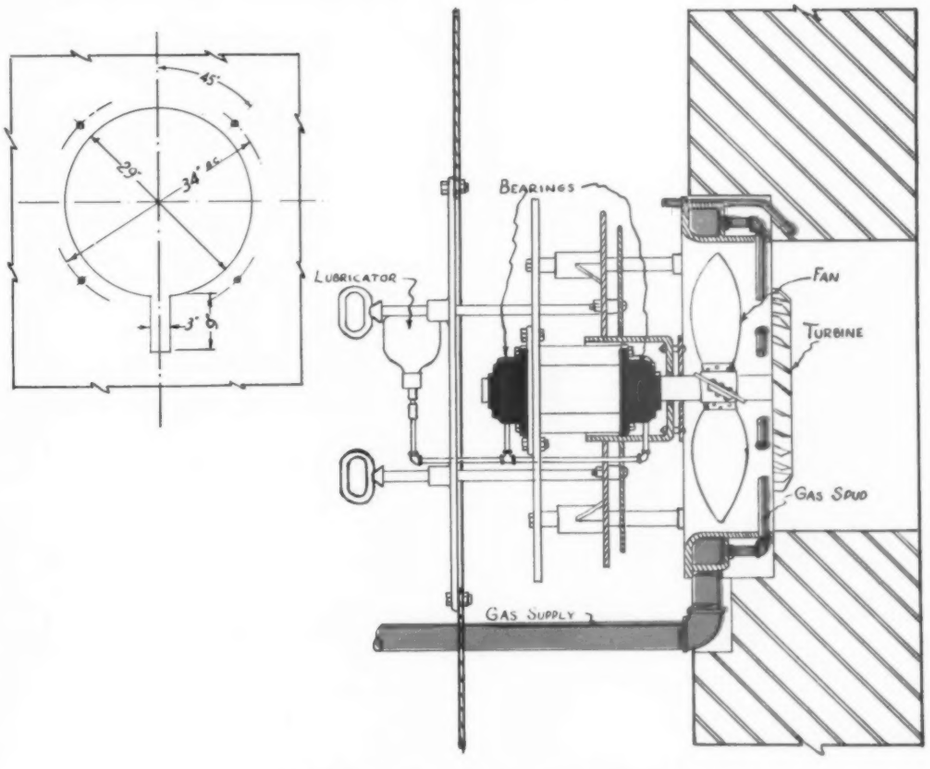
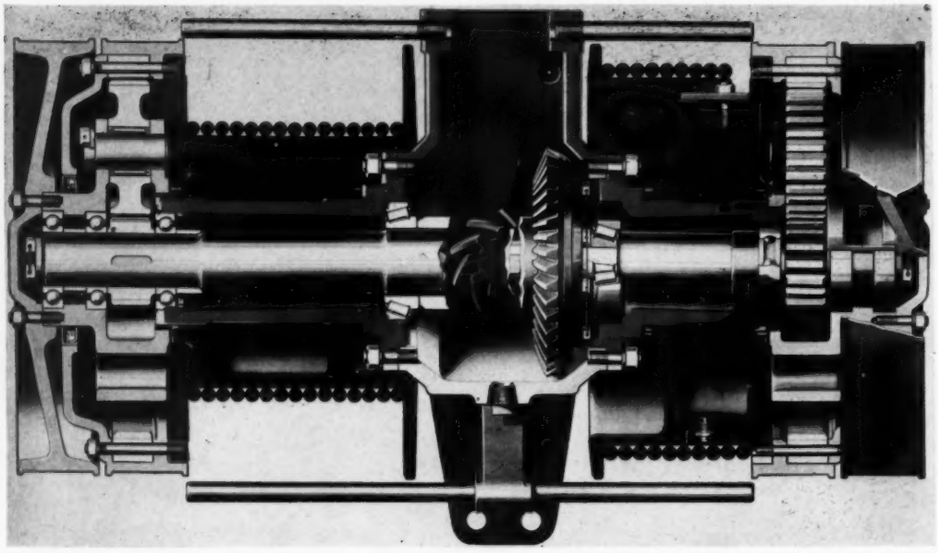


John Zink rotor gas fan type burner: red indicates gas course; blue indicates bearing.



recently developed by the MacClatchie Manufacturing Company. This combination gate and pipe packer illustrated at the right consists essentially of a set of gear-operated top doors, pipe packers (rams) and a set of geared lower doors. When the top doors are operated, the tool packs off around drill pipe . . . when the bottom doors are operated, it seals off open hole. Thus, two fast, positive-acting controls are incorporated in a single tool. Unit construction materially reduces overall height and eliminates extra flanges and threads, effecting important savings in cellar space.

Eight and a half turns of the wheel pack off the pipe in approximately 25 seconds, and six turns of the wheel pack off open hole in approximately 10 seconds. This rapid closing time is an important advantage in an emergency. Both the drill pipe and open hole packing units are designed so that the higher the pressure the tighter the seal. Fast operation is assured at all times because all working parts subject to sanding up, clogging or jamming are eliminated from the inside of the body. Instead, they are placed on the outside and encased in grease-contained housings. This eliminates the need for continually washing the unit out and does away with the need to check working condition every tour.

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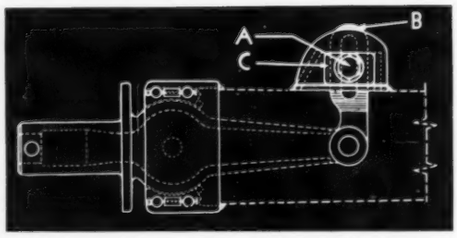
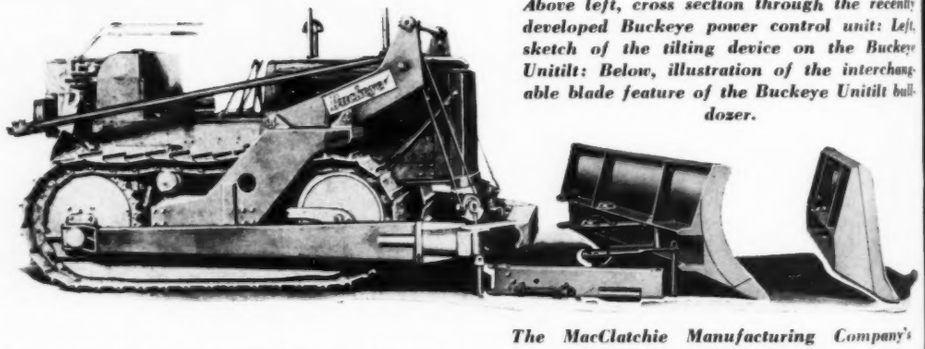
Buckeye Traction Ditcher Company

THE Buckeye Traction Ditcher Company has developed a new Unitilt cable controlled bulldozer and trailbuilder for all makes and models of tractors. The name of the new design is derived from the patented tilting device and the universality of the frame which permits using either Buckeye bulldozer or trailbuilder moldboards on the same frame. (This latter feature eliminates the original investment in two frames in order to have both bulldozer and trailbuilder and further simplifies changing over.) One man can change moldboards, which can be dismounted from the tractor by pulling two kingpins. The sidearms and other parts stay in place. The Unitilt is illustrated at the right. The tilting device is located on one sidearm and permits raising or lowering bulldozer or trailbuilder blade at either end a distance of 12 in. Turning one bolt only is all that is required to effect the tilting adjustment. Other features of the new design include: construction of the front cross beam so that the blades hug the radiator thus reducing the heavy overhanging load on the front of the tractor and reducing wear on front idlers and track rolls; blade curvature which rolls the dirt ahead, reducing dead weight and permitting bigger loads in front of the blade; 60 in. lift of blade and unlimited depth of cut below ground level; natural digging action of blade which cuts as deep as operator desires without requiring any mechanical means of creating down pressure; balanced design which prevents tipping of tractor and keeps full length of crawlers on the ground; sidearms mounted at drive axle of tractor; rigid, fully braced members to withstand all types of 'dozing work.





Above left, cross section through the recently developed Buckeye power control unit: Left, sketch of the tilting device on the Buckeye Unitilt: Below, illustration of the interchangeable blade feature of the Buckeye Unitilt bulldozer.

BUCKEYE has also improved the design of the control levers and linkage on Buckeye heavy duty power control units for Allis-Chalmers, Cletrac, and Caterpillar tractors. A cross section of the power control unit is reproduced at the top of this page. The change incorporates relocated horizontal control levels which are placed within easier reach of the operator. Better leverage is now secured and operation is simpler and more positive. The fair lead swivel sheaves have been lowered, thus bringing the direct line pull closer to the tractor drawbar, resulting in better tractor balance. Complete control lever and linkage assemblies are interchangeable with the older style mechanisms and are available for replacing them.

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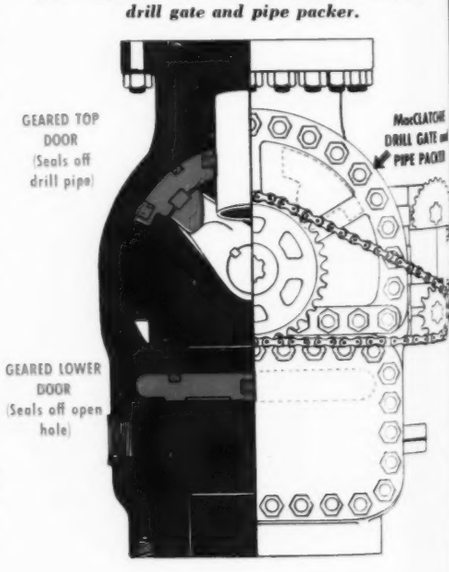
MacClatchie Manufacturing Company

EXCEPTIONALLY fast operation, space-saving compactness, rams for packing off drill pipe, and doors for open hole in the one housing are outstanding features of the drill gate and pipe packer



The MacClatchie Manufacturing Company's drill gate and pipe packer.

TECHNICAL OIL TOOL CORP.

THE Totco-Dale continuous recording instrument was designed by Technical Oil Tool Corp. to record separate classes of precision measurements obtained in oil wells, such as temperature, pressure, and electrical variations. The instrument can be run in a well at speeds up to 2,000 ft. per hour without any appreciable thermal lag. The usual running speed employed is 1,500 ft. per hour and temperature variations of .2 deg. F. can be recorded. The instrument is 1-11/16 inches outside diameter and five feet long, exclusive of sinkers. It is adapted to run in producing wells on the regular bottom hole pressure bomb line, and on the sand line in drilling wells.

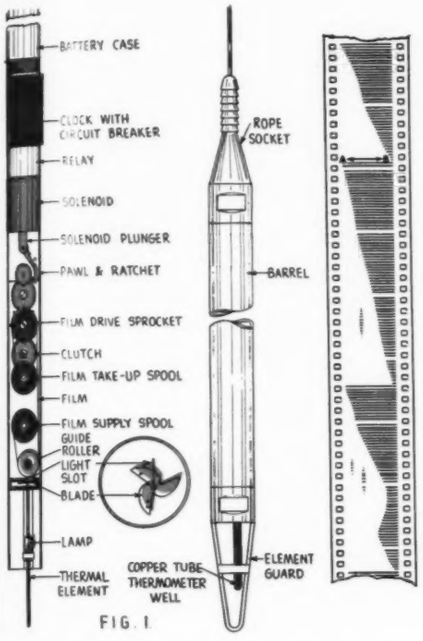


FIG. 1

Technical Oil Tool's continuous recording instrument with a sample of the record.

The Totco-Dale thermal instrument, above, consists of a fluid-tight housing or barrel with a rope socket on top and a sealed thin-wall copper tube extending out from the inside of the barrel at the lower end. The copper tube forms a well for the thermal element and is embedded in thermal insulation where it contacts the barrel. A steel band attached to the barrel protects the copper tube from damage. The barrel contains three operating assemblies: the light valve, the thermometer unit, and the recorder and battery case. The same batteries furnish the current for both the solenoid drive and the lamp. The recorder assembly includes a clock with circuit breaker, relay and solenoid with a ratchet and pawl. The solenoid, controlled by the circuit breaker, drives the film sprocket and take-up spool through the ratchet and a gear train, moving the film twice each second. The instrument accommodates nine feet of 16 mm special heat resisting film, enough to log 3,000 ft. of hole at the rate of 25 ft. per minute. The light valve unit includes a light slot or aperture .001 in. wide and about 3/8 in. long positioned at right angles to the direction of travel of the film. Light passing through the slot falls across the film in a bar within the limits of the perforations. The thermal unit with a three-bladed light masking shutter is located directly below the light slot.

The thermal unit is a bi-metal coil about two in. long terminating in an upwardly extending shaft upon which is mounted a three-bladed shutter. The coil and shaft are housed in a thin stainless steel tube which fits into the copper tube protruding from the lower end of the barrel. Variations in temperature cause the bi-metal helix to wind or unwind, rotating the shutter attached to the shaft. The entire temperature range of the thermal unit is represented in one complete revolution of the shutter. The leading edge of each of the three blades of the shutter is a spiral curve. As the shutter rotates, one or another of the blades moving across the light slot alters the length of the beam of light falling on the film from the lamp below. As soon as one blade passes over the light slot the next starts masking the slot. The temperature is indicated by the length of the beam, and each blade acts for one third of the total range of the thermal element. Thus, if a 0 deg. to 180 deg. element is used, the first blade represents 0 deg. to 60 deg., the second 60 deg. to 120 deg., and the third 120 deg. to 180 deg. One blade is blank, the next has one hole drilled through it, and the third has two holes, so that each blade can be identified by characteristic markings on the film. Fig. 2 shows the film with the three blade changes. Each blade represents the distance from "A" to "B". The right ends of the lines are the base line and the variations in the length of the lines represent the temperature variations. One wide space occurs each minute of film travel and corresponds to the record of time kept by the operator.

In the field the instrument is made up in a horizontal position and maintained in this position until ready to be run into the well. The mechanism starts to operate when the instrument is raised to a vertical position. A stop watch is started at the same time, and the instrument is run into the well to the point the traverse is to be started. The traverse is started at an even minute on the stop watch, and if the running speed is 25 feet per minute each 25 feet is traversed in one minute at controlled speed. A record is kept of the time and depth, and when the film is placed in the projector each 25 feet is identified by the wide spaces on the film. The film is developed and placed in a projection recorder. The images of the light slot on the film are projected down to a mirror in the bottom of the box and reflected up through the chart paper. The image is increased 40 times, the projected length of the longest lines being equal to the width of the glass on the top of the projector. The chart paper is held on a carriage that can be moved back and forth across the box similar to a typewriter carriage. A movable ink stylus on the carriage, controlled by a geared hand wheel, is used to follow the ends of the lines on the film as they are projected on the chart paper. The film and paper are driven through the projector by a variable speed motor operated by foot control. The movement of film and paper is synchronized so that the record taken in one minute in the well is reproduced in one inch on the chart paper. The temperature is recorded on the horizontal scale on the chart paper at 4 deg. F. to one inch. A transparent graduated chart covers part of the glass on top of the box so that the temperature at the beginning of the traverse is read and the chart carriage adjusted and locked in position.

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PUROLATOR PRODUCTS, INC.

THE recently developed Type G-140J filter manufactured by the Purolator Products Company may be used for either pressure or suction installations where flow rates are low and the amount of contamination involved is low. They are suitable for pressures up to 125 lbs. and temperatures to 300 deg. F. They are especially adapted to small engines, turbines, air compressors and small process flow rates. The head is constructed of high tensile cast iron, with screwed or flanged connections and may be equipped with a safety relief valve. Large free port areas in head and element allows maximum capacity flow with minimum pressure drop. The sump is constructed of drawn steel and is equipped with a drain plug. The element is self cleaning when revolved against cleaning blades while the filter is in operation.

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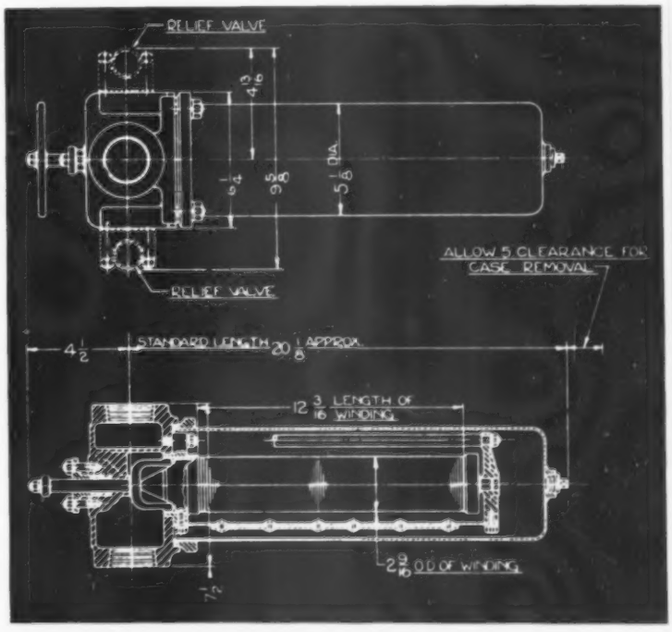

H. A. BRASSERT AND COMPANY

THE Brassert automatic self-cleaning strainer illustrated herewith will remove fine suspended solid particles from raw or process water and dispose of these particles in a continuous, automatic and self-cleaning manner. Originally designed to assure a steady flow of clean water free of abrasive and clogging particles to steel mills dependent on muddy rivers for their supply, these strainers are now used in a number of petroleum refineries. The Brassert strainer consists essentially of a slowly rotating and slightly conical drum mounted on a vertical shaft centered within a cast iron housing. The entire slanting surface of this drum is drilled with rows of deep holes into which are inserted the straining elements which are perforated porcelain discs. One or two—washout orifice cast integrally with the housing in the form of internal vertical slot is machined and lapped into the contour of the drum so as to engage one vertical row of holes on the drum as it rotates. Water or other liquids to be strained enter through an inlet at the bottom of the housing as shown by the color in the accompanying diagram; then rising around the revolving drum passes under pressure through the straining elements into the drum. In the process, matter to be strained is accumulated on the surface of screened or perforated discs and carried by the slow rotation of the drum to a backwash slot where it is flushed out by a reverse flow of clean water from inside the drum. The drum is rotated slowly so as to assure effective backwashing of straining elements every ten to twenty seconds, a period of time involving only a slight accumulation of solid matter. Dislodgement of strained matter is facilitated by differential pressure much greater during backwashing than during straining operation, as backwash connection is in direct communication with atmosphere. The discharge of clean water is effected through an outlet at the bottom of the housing, diametrically opposite inlet.

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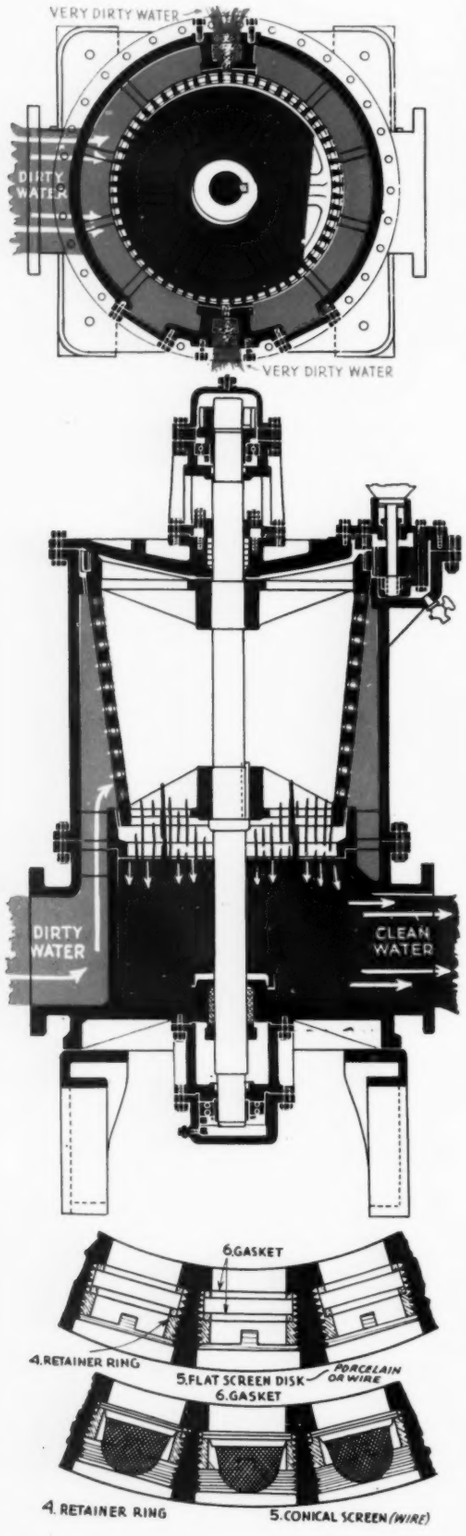
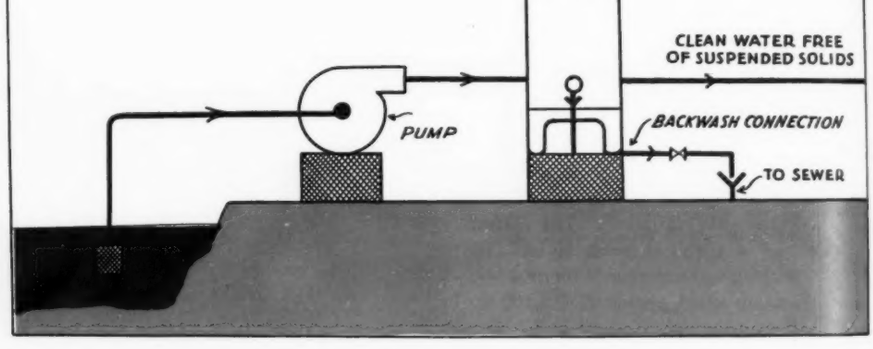


Left, diagram of the Brassert automatic self cleaning strainer with details of the porcelain strainer units. Below, hook up of the Brassert cleaner.



Cardwell Manufacturing Company

CARDWELL deep well single drum servicing hoists illustrated below are specially designed to handle deep well jobs (8,000-12,000 ft.) and yet the compact, lightweight construction makes them easily transported or operated on a truck or trailer. A rotary table drive assembly is available as optional equipment on both models and can be installed in the field. The positive jaw clutches and SKF self-aligning bearings insure a free rolling drum. A dual safety braking system operates with one-half the ordinary pressure and enables either brake to operate independently and hold the load should the other be damaged. Brake flanges with water trough for cooling are fabricated with special alloy steel and heat-treated for toughness and hardness. Drum ends and drives are fully shielded for maximum safety.

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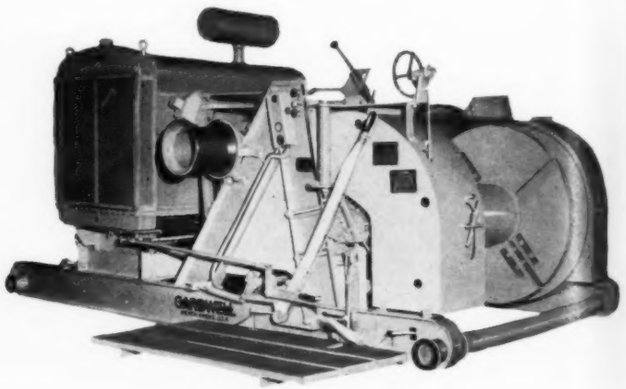

Cardwell Company's deep well single drum servicing hoist for depths to 12,000 ft.

WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY

Two developments of the Westinghouse Company are illustrated herewith: one being the oil immersed control; the other, the unit design control center. The illustration shows the overhung tap casting which permits conduit entrance from any direction—top, sides, bottom, or back. It is especially suitable for straight-through wiring where a number of starters are attached to a common power circuit. All live parts are oil immersed for protection against corrosion and explosion. It is extremely accessible with breaker mounted in rear of panel and starter, relays, resets, interlocks on panel front. Safety features are represented by individual barriers to cover all line parts. Unless two barriers are removed, operator cannot accidentally get across line voltage. Extra large contacts with low losses and current densities carry heat away rapidly.

Unit-design control centers make possible all the advantages of modern, attractive, efficient, centralized control at comparatively low cost. This may involve the safe and convenient placement, grouping and centralization of all starters for a single machine, group of machines, or an entire plant. They may be arranged on any floor for front mounting, back to back, "L" shape, "U" shape, or control aisles. The steel structure of these control centers is designed for mounting motor starting devices in any size up to and including NEMA size 4 starters which will accommodate squirrel cage motors up to 100 hp. at 440 volts and 50 hp. at 220 volts. Installation and wiring are simplified where a number of starters are involved. The illustration shows a typical Westinghouse 5 structure, control center.

A third recent development, the mass spectrometer, was designed at the Westinghouse Research Laboratory principally to solve routine gas analysis problems. However, its use has been extended to valuable work in connection with analyses of petroleum hydrocarbons. As research background is obtained in this latter connection it is possible that the instrument may ultimately be used advantageously and widely in process control work in refineries as well as chemical plants. The compactness and portability features of complete unit ready for operation may be seen from the illustration. The individual parts of the instrument are all readily accessible and removable due to the panel-type construction of the enclosure.

Above, the Westinghouse Company's oil immersed control, and left, the unit design control center.

DOWELL INCORPORATED

Dowell has recently developed a system of chemical application to wells producing from sand reservoirs in addition to the conventional acidizing of acid soluble limestones. Known as formation cleaner treatments, the chemicals used contain no acid; their solvent action being confined to paraffinic, resinous and bituminous materials occurring in the well, tubing, pump parts and casing. Formation cleaner treatments, as illustrated on the left are made down the tubing and squeezed into the formation by the use of pumps if the well can be filled with fluid; if the well will not fill, the fluid head can be raised sufficiently to force the chemicals into the formation. In areas where gas is available it is often desirable to displace the chemicals into the formation in this manner. Many treatments have also been made merely by introducing the chemical down the casing, providing the casing has been set somewhere near the top of the pay.

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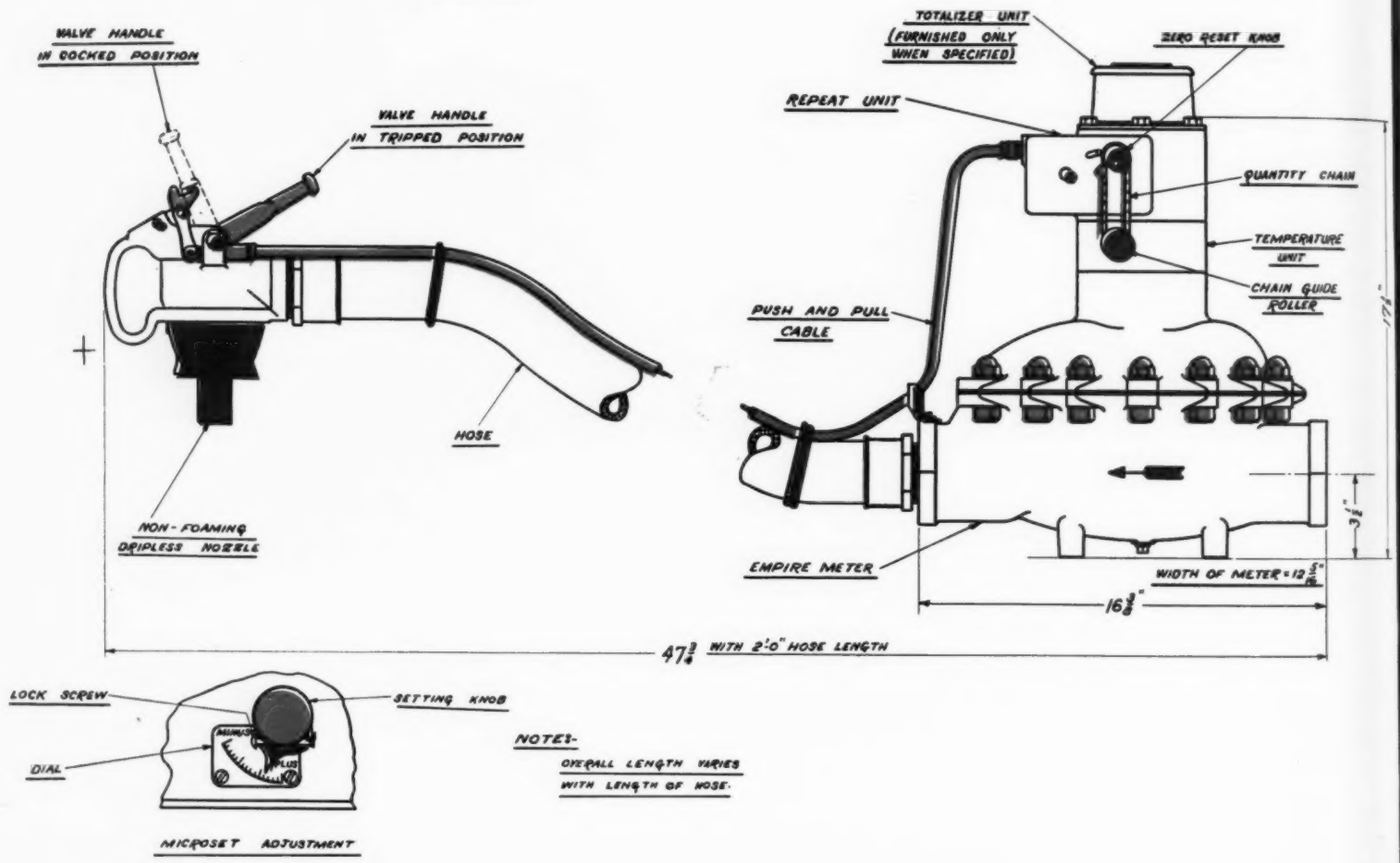
PITTSBURGH EQUITABLE METER COMPANY

THE National Meter Division of the Pittsburgh Equitable Meter Company has recently designed a new type of drum filler of interest to refiners, compounders and distributors. This unit known as the Empire Thermostatic Drum Filler, illustrated below, consists of an Empire oscillating piston, positive displacement meter, a thermostatic microset for automatically correcting the meter measurement to the exact equivalent of the desired volume at 60 deg. F., a repeat register with exterior quantity chain having a fixed cam thereon which trips, and a mechanically operated control valve with non-foaming, dripless nozzle of integral construction.

To change from one predetermined delivery amount to another is accomplished by simply installing a quantity chain of the proper length on the side of the repeat register. Quantity chains in lengths of from 10 to 100 gallons per cycle can be furnished. A substantial increase in barreling speed over the measure by weight method is accomplished through the use of this unit. It eliminates constant thermometer checking, reference to complicated charts and calculations, and requires no setting and resetting of adjustments for temperature changes.

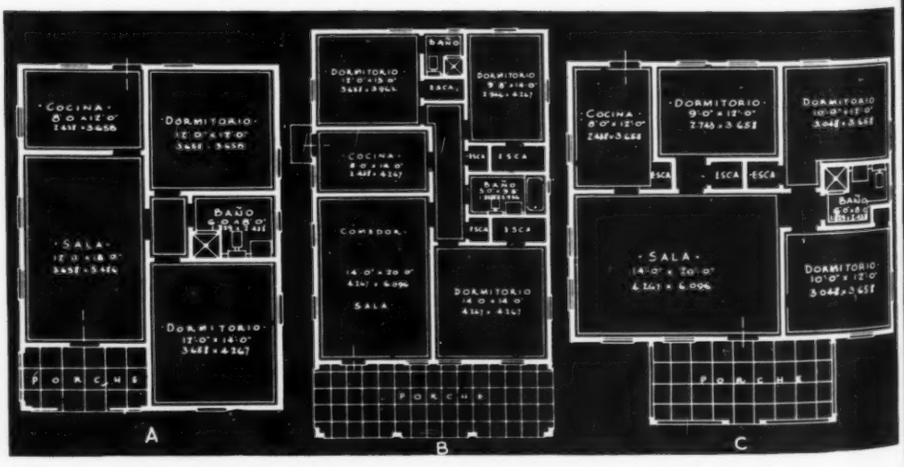
The Empire thermostatic drum filler developed by the National Meter Division of the Pittsburgh Equitable Meter Company.



NOTE:- OVERALL LENGTH VARIES WITH LENGTH OF HOSE.

Armor Products Company

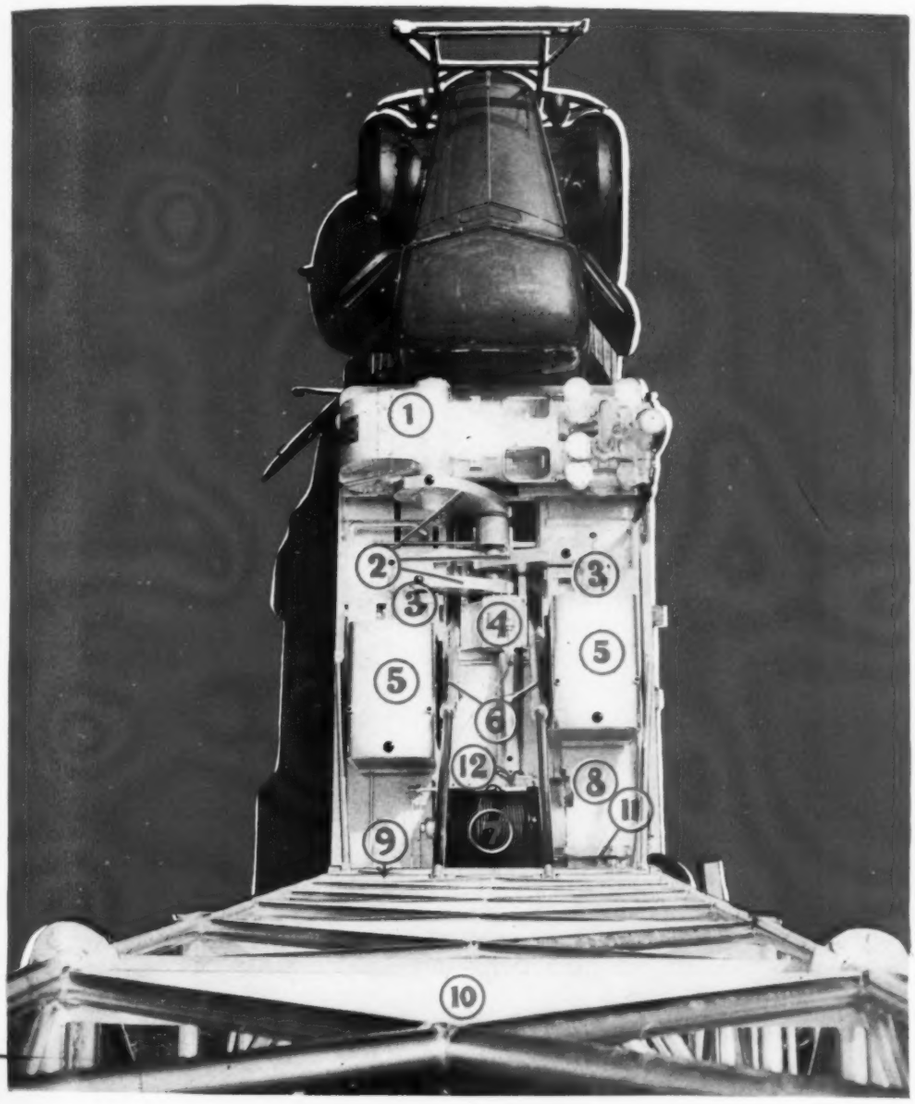
THE Armor system of Petroleum Housing is designed for speed of erection and demountability, factors of great importance to the national war effort. Materials are cut to size at the factory, compact shipments of steel framing, insulating board, roofing, etc., are forwarded to field or refinery. There they are assembled into panels which are fastened together to form dormatories, mess halls, infirmaries and individual housing units. These houses; illustrated at the right, are adapted to all types of foreign service.



Floor plans of three typical Armor houses particularly suitable for tropical use.

SULLIVAN PORTABLE DRILL

THE improved Sullivan No. 200 Core Drill is a completely portable heavy duty unit for structure testing, electrical sub-surface surveys or shallow slim-hole production. As mounted on a truck it is illustrated below: on the right is shown a side elevation of the unit. This core drill has a rated capacity of 2,000 ft., a hoisting speed range of 15 to 325 ft. per minute and a single line rope pull of 10,000 lbs. based on 1,800 r.p.m. engine speed.



Referring to the numbers in the above illustration (1) is the mud pump; (2) completely enclosed bath lubricated chain drives from power units and to mud pump; (3) bus-type power unit clutches and transmissions; (4) reversing clutch for rotary table and drawworks; (5) dual power units; (6) dual hydraulic mast lifting cylinders; (7) drawworks; (8) welded one-piece frame; (9) centralized hydraulic control valves; (10) welded steel tubing derrick; (11) cathead drive, and (12) dual transmission for rotary table and drawworks drive. As may be seen the principal features include a reversible, multiple speed rotary table, hydraulic feed, automatic chuck, multiple speed drawworks and cathead, mud pump, table retracting mechanism, hydraulically elevated and lowered derrick and power drive from either single or dual engines or through takeoff from the truck engine. The assembly is supported by a single rigid frame mounted on suitable motor truck, trailer, semi-trailer, crawler tractor or wagon or skids. Drill rods can be used with or without a kelly (grief stem) and the hydraulic feed can be applied to the kelly as well as the rods. The automatic chuck is an exclusive Sullivan feature. It is hydraulically actuated and eliminates hand set screws with consequent saving in labor and increase in drilling speed and safety.

The unit has a capacity of 2,000 ft. of hole drilled with a 2⅜ in. internal flush joint drill pipe. Hoisting drum can carry 900 ft. of ½ in. rope; 600 ft. of ⅝ in.; or 400 ft. of ¾ in. With the engine making 1,800 r.p.m. using a single line the unit can raise 7,500 lbs. 150 ft. per minute in low gear; or 5,000 lbs. at 250 ft. per minute in second gear; or 3,000 lbs. at 425 ft. per minute in high gear. The rotating speed of the table is from 24 to 525 r.p.m. There is a three-inch opening in the rotary table. The unit has two hydraulic cylinders four inches in diameter with 36 in. of hydraulic feed, a hydraulic working pressure of 500 lbs. and a maximum pump pressure of 1,000 lbs. The unit is equipped with control valves for direction and rate of feed, feed pressure, raising and lowering mast, retraction and automatic chuck. The cathead is six inches in diameter and six inches in length. The drill transmission has three speeds: The truck engine transmission gives additional ratings making 12 speeds forward and three reverse. Gardner Denver 4½ in. by 6 in. pumps are supplied. The mast is 40 ft. in height, tested for 20,000 lbs. working load having a double sheave crown block.

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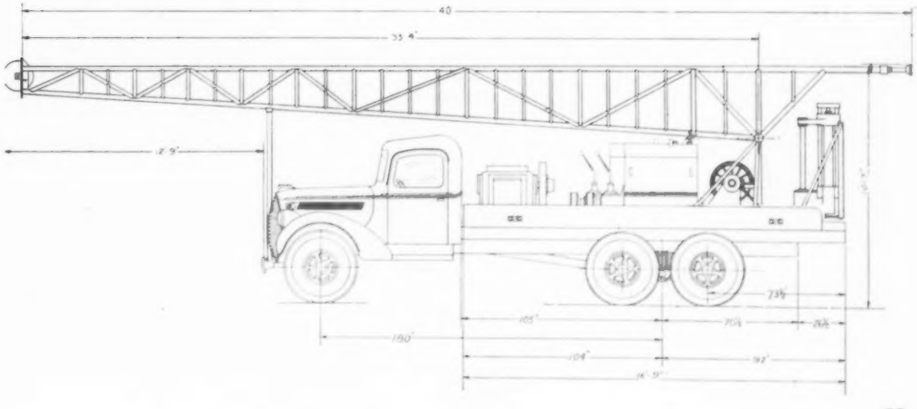
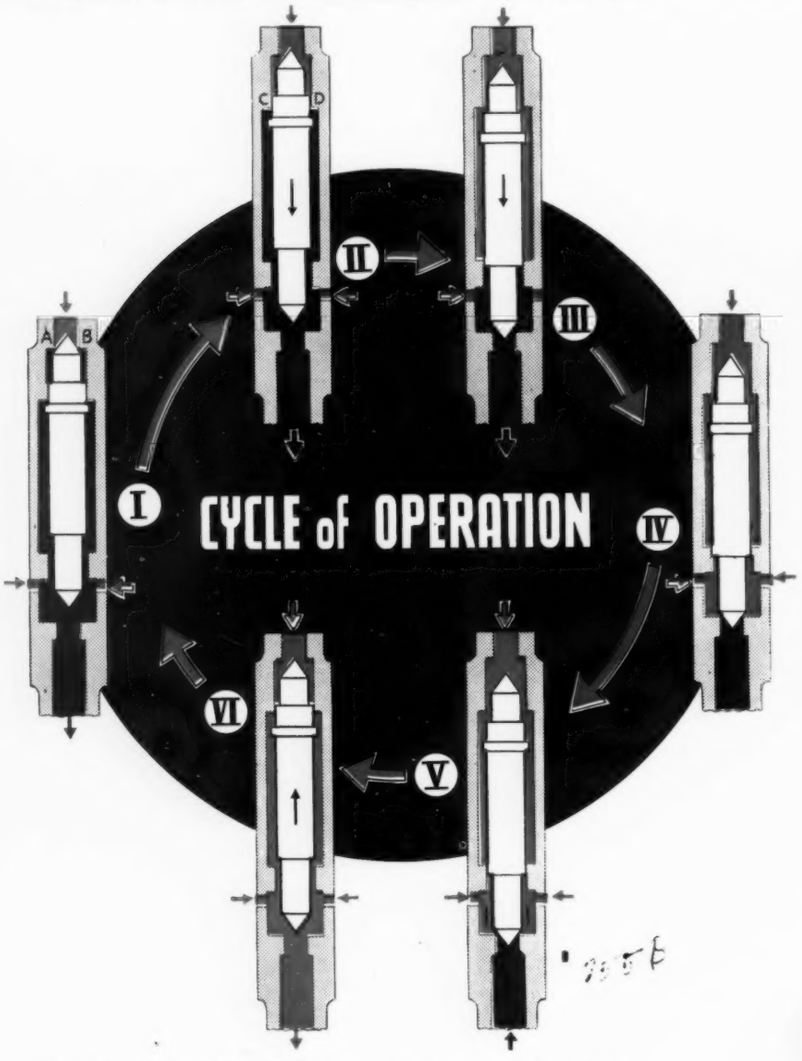
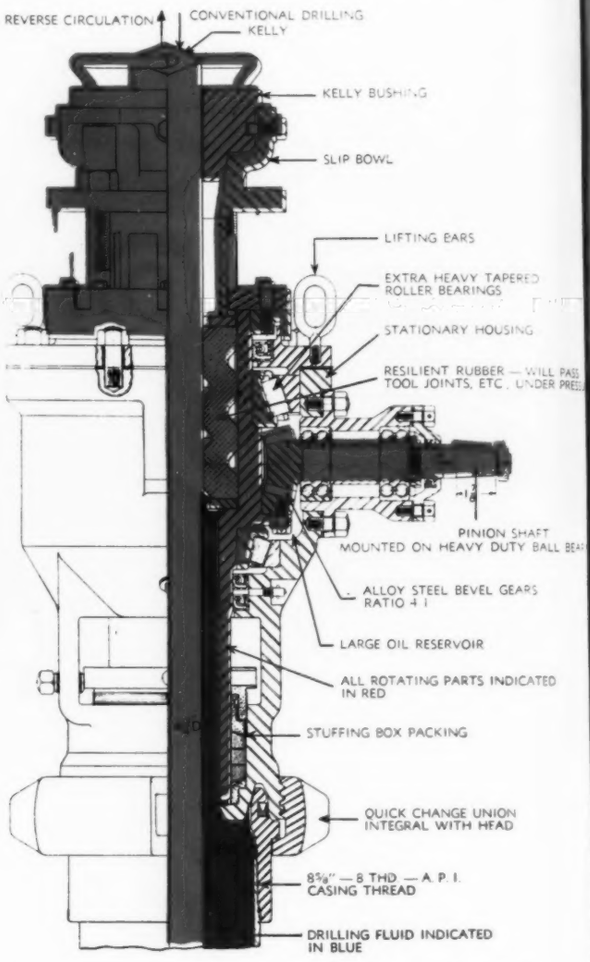
Left, truck mounted core drill developed by Sullivan Machinery; figures are described in the accompanying text. Below, a side elevation of the same unit.



THE GUIBERSON CORPORATION

THE Type C pressure-controlled flow valve designed by Guiberson, is an automatic gas lift flow valve, designed for efficient operation in producing oil wells. Detailed explanation of valve operation is provided by the color diagrams of the cycle of operation. (I) Valve in open position. Valve stems off lower seat, allowing gas coming through gas ports to pass through into tubing. Due to restrictions of ports, a pressure differential exists between inside of valve and outside casing pressure that is proportional to pressure within tubing. Casing pressure also exerted on top of valve stem at upper seat A-B. As pressure in tubing lessens due to fluid load being lifted, the pressure differential within valve at A-B causes valve stem to leave upper seat. (II) Casing pressure is then exerted on the larger piston area of valve stem at C-D. The area at this point is approximately five times the exposed area presented by valve stem at A-B. Thus the force exerted by the casing pressure tending to close valve, once valve stem leaves upper seat, is suddenly multiplied five-fold. (III) As piston at upper portion of valve leaves sleeve C-D, the large piston area at lower end of valve stem engages sleeve E-F in valve housing immediately above the gas ports. The very large force exerted by casing pressure is thus applied to lower end of valve stem which has the same area at E-F as at C-D, insuring a forceful, movement of valve stem until it seats. (IV) Valve closed. Casing pres-

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CONVENTIONAL DRILLING
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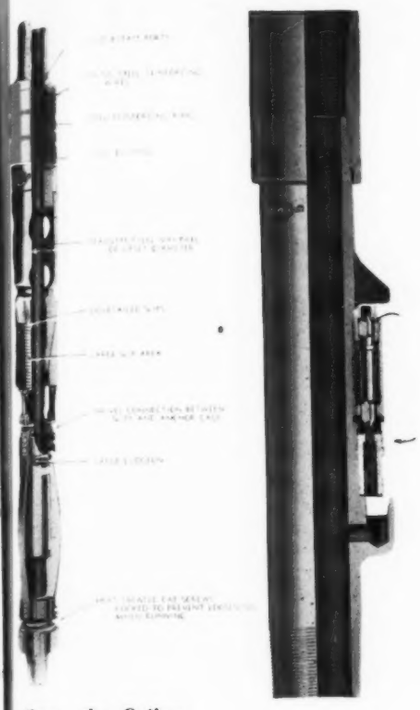
KELLY BUSHING
SLIP BOWL
LIFTING BARS
EXTRA HEAVY TAPERED ROLLER BEARINGS
STATIONARY HOUSING
RESILIENT RUBBER — WILL PASS TOOL JOINTS, ETC., UNDER PRES
PINION SHAFT MOUNTED ON HEAVY DUTY BALL BEA
ALLOY STEEL BEVEL GEARS RATIO 4 1
LARGE OIL RESERVOIR
ALL ROTATING PARTS INDICATED IN RED
STUFFING BOX PACKING
QUICK CHANGE UNION INTEGRAL WITH HEAD
8⅝" — 8 THD — A. P. I. CASING THREAD
DRILLING FLUID INDICATED IN BLUE

Above left. Cycle of operation of the Guiberson type C flow valve: Above right, combination pressure head and rotary table.

Right, the Guiberson type B tubing spider.



Above, the Guiberson type H3R packer.

sure in valve is exerted downward. (V) Valve closed, fluid rising in tubing. Fluid build-up in tubing transmits an upward pressure against bottom of valve steam proportional to height of column and gravity of fluid. Valve stays closed as long as pressure of gas above lower seat is greater than pressure of fluid below seat plus spring tension on valve stem. (VI) When pressure exerted by fluid in tubing against bottom of valve stem, plus spring pressure, is greater than gas pressure above, the valve leaves its lower seat.

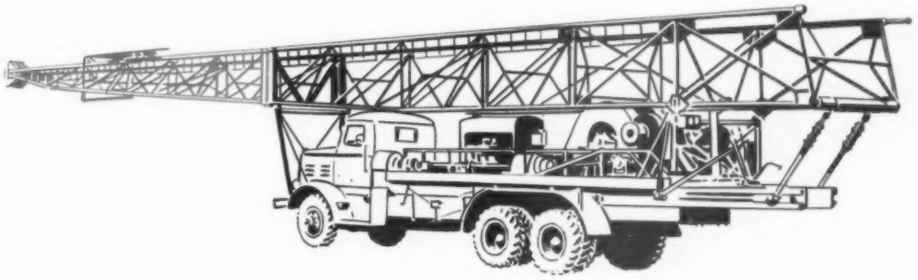
The Guiberson Corporation manufactures the Type H combination drilling head and rotary table illustrated herewith. This drilling head will provide positive pack-off between casing and kelly, drill pipe or tubing and eliminates the necessity of having to use a separate rotary table as it incorporates essential elements of a rotary table, kelly bushing, slips and slip bowl, as integral parts of the head.

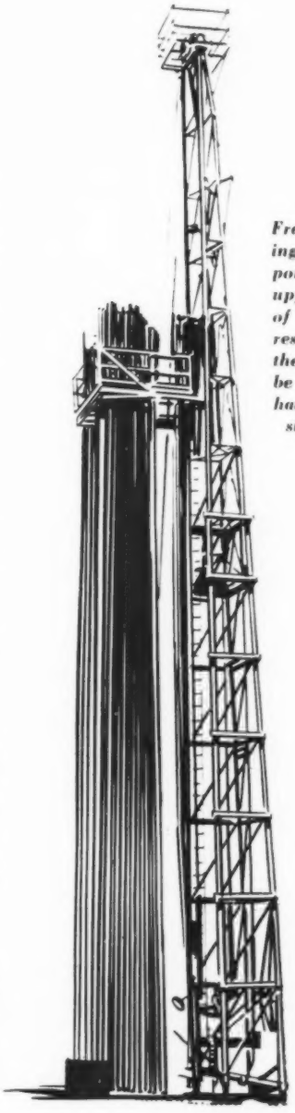
The Guiberson Type B tubing spider illustrated has sufficient strength to carry the heaviest tubing loads and yet is extremely light. Slip bowl weighs only 96 pounds. Large slip area gives full support of tubing walls preventing damaged tubing and gives the operator assured tubing safety. Slips fit bowl true, regardless of their vertical position due to their narrow backs.

The Guiberson Type H3R packer is illustrated above. Ease in setting and pulling from well, full recovery of rubbers without damage, fluid by-pass when pulling, dovetailed slips and seamless steel mandrel of upset diameter, enable this packer to handle toughest well applications.

FRANKS MANUFACTURING CORPORATION

A PORTABLE truck-mounted two-section 84 ft. derrick, which permits pulling in doubles, the top portion of which may be easily and quickly removed for long-distance hauling, has been developed by the Franks Manufacturing Corporation and is diagrammatically illustrated herewith. The two derrick sections are fastened together in positive alignment on the ground before the derrick is raised. The joints are entirely rigid through the use of self-aligning tapered plugs and bolts. This 84 ft. derrick may be folded down over the truck and left in one piece for short moves. It is raised within five minutes by a patented screw-raising device driven by the power plant of the unit; no auxiliary engine, pumps, hydraulic lines or cylinders are needed. The derrick has a capacity of 150,000 lbs. It is open face design, of light weight, and is completely electrically welded. The legs and principal members are of S.A.E. 1015 cold drawn seamless tubing in finish annealed condition. Secondary members are of structural steel shapes. The 84 ft. derrick is only 44 ft. long in the over-the-road position for long moves with the top section removed. Only a light truck and trailer is required for transporting the top derrick section. These units are arranged for three-man crew operation without lessening drilling speed or working undue hardships on men. The cat shaft in front of the drawworks — with regular, automatic, and spinning line cathead, affords sufficient facilities for tonging and spinning, making possible efficient operation with a three-man crew. Not only is the Franks 100 percent portable drilling rig unitized; it is also perfectly balanced with derrick, drawworks, pumps, power plant, and all features correctly designed for its recommended depths. The 84 ft. derrick portable drilling rig is capable of drilling a 5,000 ft. slim hole.





Franks Manufacturing Company's 84 ft. portable derrick. The upper or red portion of the diagram represents the part of the derrick that may be removed for long hauls, reducing the size to only 44 ft.

A special feature of the rig is the fact that the derrick may be left standing in the field while the truck and winch are used elsewhere. The derrick may be left standing with tubing racked, supported solely by the guy wires. An obvious advantage of this feature is the economy which results when the truck and winch unit may be used under a standard derrick or with other equipment before a servicing job is completed. Another new device on the Franks telescoping well servicing units is the optional safety signaling device, which is an electrical alarm arranged to indicate by lights and horn signals when the derrick is telescoped to its full height and ready to be locked.

U. S. AND MEXICO Reach Oil Agreement

Mexican Government To Pay Roundly $24,000,000 for Properties Seized in 1938 but Companies Remain Liable for Private Claims Filed Against Them.

ANNOUNCEMENT was made simultaneously in Washington and Mexico City on April 18 that negotiators representing the governments of the United States and Mexico had reached an agreement upon the sum to be paid by the latter in settlement of claims of American-owned oil companies for seizure of their Mexican properties in March, 1938. This was in pursuance of an understanding arrived at several months ago according to which each government was to designate a representative to act in the matter. At that time it was stated that if the two representatives reached an agreement their decision was to be final. Morris L. Cooke, former head of the Rural Electrification Commission, was designated to represent the United States, and Manuel J. Zevada, a member of the Mexican oil administration, acted for Mexico.

According to press reports the total amount agreed upon for indemnification of the oil companies was $23,995,991 to be distributed as follows: Standard Oil Co. (New Jersey) group $18,391,641; Standard Oil Co., of California $3,589,158; Consolidated Oil Co., $630,151; Sabala Oil Co., $897,671, and others $487,370. One-third of the amount was to be paid over to the United States on July 1, 1942, and the remainder in five annual installments. Before the payments were transferred to the companies however it was stipulated that they should surrender all documents and instruments of title to their properties and a complete release of all claims.

One provision of the agreement which has drawn considerable comment as containing a possible joker specifies that the oil companies shall be relieved of responsibility for claims lodged against them by the Mexican government subsequent to the taking over of their properties but shall be required to accept liability for private claims made previous to the date of the agreement if these are sustained by the Mexican courts. It is reported that claims of this class filed against subsidiaries of Standard Oil Company (New Jersey) aggregate some 300,000,000 pesos. Should these claims be approved by Mexican courts the company would be in the position of receiving nothing for its properties but actually owing a large sum to Mexican claimants.

In the determination of the matter the oil companies concerned had no part and no explanation has been published of the basis adopted for determination of the amounts to be paid them. From the size of the award it is assumed, however, that the United States abandoned the original position taken by the State Department that the value of sub-soil rights should be taken into account, a contention opposed by the Mexican Government which asserted that only surface structures and improvements should be included. This question was the nub of the whole controversy between the Mexican Government and the oil companies. These companies acknowledged the right of the government to expropriate their properties providing they received adequate compensation, but they held that this clearly should include the underground deposits in fields discovered and developed by them, since their properties were held in fee simple and their title to mineral rights had been upheld by the Supreme Court of Mexico and confirmed by agreement between the executive departments of the two governments. While the oil companies never have gone on record, so far as known, as to the value they placed on their holdings, the figure of $150,000,000 has been published as an approximation of the worth of American-owned properties.

Much more extensive were the holdings of the Royal Dutch Shell group, including a large part of the great Poza Rica field. These properties were generally estimated to be worth double the value of those held by Americans. The claims of the Royal Dutch Shell subsidiaries are not affected by the recent award, since these are British companies subject to separate negotiation.

Up to the time of writing, no announcement has been made by the oil companies as to their acceptance or rejection of the terms agreed upon by the two governments. In Mexico, the decision was hailed as a decisive victory for the Mexican Government. Press comment in the United States suggests that the anxiety of the administration in Washington for continental solidarity in the war effort may have been a factor in the final decision and in the loans and concessions recently granted to the Mexican Government.

By direct negotiation between Cities Service Company and the Mexican Government, that company is to receive something over $1,000,000 in payment for properties taken over by the government and retains possession of four undeveloped properties which were not included in the expropriation, with their subsoil rights.

Burma's Oilfields and Refinery Destroyed

NEWS DISPATCHES announcing the occupation of Yenangyaung, Burma, by Japanese forces in mid-April carried the information that the wells in that important oil field of Burmah Oil Company, Ltd., had been effectively destroyed before the position was abandoned by British troops. A month earlier, at the time of the evacuation of Rangoon, the large refinery of this company at Syriam, adjacent to the city, where most of the oil was refined, had been completely demolished by heavy charges of high explosives which left the plant a mass of tangled wreckage, blew up the storage tanks and set fire to their contents which spread over the harbor in a sea of fire that wiped out all harbor installations and many water front buildings. At the same time the pipe line connecting the field with the refinery was blown up most effectively at several points.

As a result of the complete destruction reported, possession of the former oil producing area can be of no immediate advantage to the Japanese, but it does deprive India of an important source of oil and cuts off supplies formerly moving into China over the Burma Road.

Burma's oil production in 1941 was estimated at 7,760,000 bbl. or about the same as the average for the past several years. The number of producing wells, according to the latest available report, was about 3,800. The rated capacity of the refinery was 20,000 bbl. daily with a cracking capacity of 3,000 bbl. daily. Refined products supplied local and nearby Indian markets.

John H. Baird well known international oil equipment export representative has entered into an agreement with Unit Rig and Equipment Company to promote the sale of that company's power rigs and winches in foreign fields.

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WORLD PETROLEUM ABSTRACTS

Summaries of the Most Important Articles as Published in the Oil Press of the World Dealing with Technical and Economic Aspects of the Petroleum Industry — Edited by Dr. O. W. Willcox.

GEOLOGY

Geologic Distribution of Oil in the Illinois Basin—B. F. Hake, before AMERICAN PETROLEUM INSTITUTE, PRODUCING DIVISION, EASTERN DISTRICT, Pittsburgh, April, 1942.

Oil produced from fields developed in the Illinois basin since January 1, 1937 comes from about twenty formations. Because many wells produce simultaneously from two or more of these, the producing horizons are grouped into nine zones. The Lower Chester sands and the Lower Mississippian limestones appear to have furnished about 83% of all the oil and the production from Lower Chester sands seems to be about twice that from the Mississippian limestones. Devonian limestones have yielded about 12% of the total oil produced from the new fields of the basin. In five years the new fields have produced about 43% of all the oil produced from the basin in thirty-five years.

All the oil producing formations of the Illinois basin have one characteristic in common; porosity and permeability within each of them are extremely variable and erratic, both as to quality and distribution. The influences of these variations have tended to produce a large number of small oil fields in each productive zone. On well developed anticlines and domes there has been a strong tendency toward the formation of commercial accumulations in the same area at several different depths. Because of the variations of the lithology within each formation, a perfect superposition of one oil body over another, under structural influences, was seldom attained, though the oil bodies at different levels are generally overlapping.

This composite effect of structure and stratigraphy is more marked on the eastern side of the basin than on the western. When such oil deposits are mapped without regard to formation from which the oil is obtained, the resulting picture displays extensive productive areas or irregular, sprawling forms such as characterize most of the published maps of the oil fields of the LaSalle anticline and Wabash River districts.

On the western side of the basin, some of the productive sands are more uniform in their physical characters, and the structural influence has been more effective. There, large, prolific oil fields of symmetrical forms are found with their deeper productive areas vertically beneath the shallower ones.

DRILLING

Use of Gel-Type Cement to Cement Casing—John T. Reynolds, before AMERICAN PETROLEUM INSTITUTE, PRODUCTION DIVISION, EASTERN DISTRICT, Pittsburgh, April, 1942.

The practice of cementing casing in the Eastern District of the A.P.I. has grown to large proportions, mainly due to the new drilling play in Illinois which brought rotary drilling into the Eastern District on a large scale. Results on several thousand cementing jobs now make it possible to draw conclusions upon the use of high water ratio, low compressive strength, gel-type cement as against the use of neat cement for cementing casing. The use of gel-type cement in cementing casing must be successful, as its use is the rule rather than the exception in the Eastern District at this time.

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The Campbell Hi-reach Fire Gun takes the nozzle immediately to the most effective position—close to the fire—and keeps it there without danger or risk either to personnel or expensive equipment. Uses to the best advantage every drop of water or foam. Can be man-handled even when in operation and can be left without attention in an otherwise too dangerous position. The fire gun enables the jet to be played from above quite close to the fire, or in the case of fires near ground level the nozzle can be projected right into the heart of the fire. Can operate at nearly any angle between vertical and horizontal.

The fire gun enables full use to be made of the very useful, but hitherto ungetatable positions such as narrow roads, alleys at the back of buildings, etc.

The Campbell Hi-reach Fire Gun is a self-contained unit which will operate from a hydrant or pump (only 40 lbs. per sq. in. pressure necessary to extend the gun), and will deliver foam or water with equal ease and efficiency; and it can deliver 1,400 gallons of foam per minute.

At a recent demonstration over 600 gallons per minute was delivered through a $1\frac{5}{16}$ in. nozzle at a pressure of 150 lbs. per sq. in. During this severe test the Fire Gun was man-handled whilst in operation without in any way impairing its stability.

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MOLY

Gel-type cement was first used in the Eastern District on single string completions of cable tool wells. The use of high water ratio, low compressive strength, gel-type cement has proven a valuable aid to the problems of cementing casing on rotary, as well as cable tool drilled wells. The use of bentonite admix in small percentages, usually 1% to 4%, allows running up to 100% more water than in neat cements. This results in a decided saving in costly materials. Results on 6,300 wells in the Illinois Basin show that further savings are effected, as the number of cementing failures are reduced over 57%. The cementing problems in the Illinois field have been particularly difficult due to the necessity of cementing casing from bottom to top, the removal of more than 1,050 windows in the above 6,300 wells to make multiple completions, and extensive shooting with nitroglycerine. It is proposed that effective mud control be used in drilling operations to condition the well for cementing as well as an aid to drilling problems and when used in conjunction with gel-type cement this will effect even more savings.

ASPHALT & TAR

Measurement of Oxidation Stability of Road Asphalts—A. P. Anderson, F. H. Stross and A. Ellings, in INDUSTRIAL ENGINEERING CHEMISTRY, ANALYTICAL EDITION, Vol. 14 (1942), No. 1, pp. 45-49.

Two new test methods are described for determining the oxidation stabilities of asphalts to enable a forecast of their road behavior. The first method is a rapid one for routine testing of asphalt shipments and uses data that may be obtained by means of the standard loss on heating test. Specimens are heated at 163° C. and the log of penetration at 5-hour periods is plotted against time in hours. In this way a resistance-to-hardening figure is obtained. By comparison with service (road) tests it has been observed that no asphalt having a resistance value above 55 ever gives a poor service record; contrariwise, no asphalt with a resistance figure below 55 has a good service record.

The second, more accurate test has been designed for testing unknown asphalt. In this test the asphalt in benzene solution is subjected to the action of oxygen at a high pressure but at a temperature within the range which the asphalt will encounter in service. During the test the asphalt will absorb oxygen, and the pressure will drop. The logarithim of the penetration after oxidation is plotted against pressure drop for 3 (or more) runs; the amount of oxygen needed to reduce the penetration to the value of 20 is called the hardening ratio and is expressed in pounds per square inch. Dividing oxidation ratio by hardening ratio and multiplying by 100 gives the deterioration index.

CHEMISTRY

Dielectric Properties of Hydrocarbons and Hydrocarbon Oils—J. C. Balsbaugh, A. G. Assaf and J. L. Oncley, in INDUSTRIAL ENGINEERING CHEMISTRY, Vol. 36 (1942), No. 1, pp. 92-100.

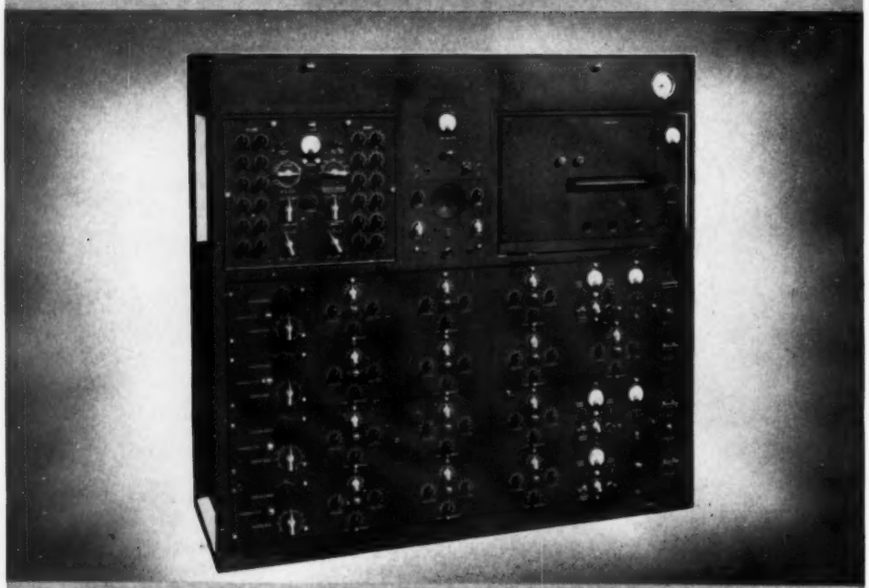
Transformer oils and electrical insulating oils in general are expected to show good dielectric properties. These properties are likely to be affected by various circumstances, including oxidation. Studies of these phenomena have given widely varying results, and the authors have made a new approach to the subject.

A representative group of straight hydrocarbons and a series of related hydrocarbon oils was studied under different oxidation conditions. This work indicates that the study of pure hydrocarbons is useful in interpreting the oxidation mechanism of commercial hydrocarbon oils.

The oxidation of a paraffinic hydrocarbon and a water-white aromatic-free oil in the presence of copper gave a copper salt of a composition close to that of a 5-carbon di-basic acid or its homolog. The oxidation of a hydrocarbon or a hydrocarbon oil in the presence of copper under limited oxidation conditions, in which relatively small amounts of oxygen are made available to the sample, may produce a highly dissociated electrolyte giving relatively high conductivities or power factors.

Electrical measurements of conductivity and dielectric constant of the oil itself and of the oil in combination with paper gave useful information for analyzing the mechanism of oxidation or deterioration. The use of a limited oxidation test for evaluating the power factor stability of an oil in the presence of copper should be important in commercial applications of electrical insulating oils.

Western Pioneers
Multiple Recording



ANOTHER WESTERN GEOPHYSICAL ADVANCEMENT

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3. *Newly developed filter circuits which have proved of great value in obtaining satisfactory records in many difficult areas heretofore considered unworkable.*
4. *Extreme flexibility—four 6-trace records, two 12-trace records, or one 24-trace record may be obtained as desired.*

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WESTERN'S new 24-Trace Seismograph Unit provides from 2 to 4 complete records per shot, obtained simultaneously with different filters. It permits a more thorough and accurate study of seismograms by placing *two or more* records on a single film. In addition, it speeds up operations in the field and makes important savings in explosives.

This multi-record innovation ranks in importance with the far-reaching advancement of the multi-string camera, which replaced single string types and opened up extensive new opportunities in exploration technique.

In the new 24-Trace Unit, WESTERN brings oil operators *another* important addition to its modern, complete and dependable geophysical service. May we have the opportunity of presenting complete details?

Western GEOPHYSICAL COMPANY

HENRY SALVATORI, PRESIDENT

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Pyrogallol Derivatives as Gasoline—W. W. Scheumann and John H. Haslam, in INDUSTRIAL ENGINEERING CHEMISTRY, Vol. 34 (1942), pp. 485-488.

Cracked gasoline deteriorates in storage, and a resinous gum forms in appreciable quantities. This gum will cause serious difficulties in internal combustion motors, and it is therefore common practice to add small quantities of antioxidants or gum inhibitors to such gasolines during refining.

The antioxidant properties of various phenolic compounds have been extensively investigated in recent years, and many are being successfully used. In most operations the antioxidant is added to the gasoline immediately after it has been treated, at which time the gasoline often has suspended in it small particles of water in the form of a haze. This water settles out in the storage tanks, and if the antioxidant used is water soluble, a considerable portion is extracted from the gasoline. The relative solubilities of antioxidants in water and gasoline are of great importance and must be considered along with their inhibiting effectiveness.

Unfortunately many phenols which are powerful antioxidants are unsatisfactory from the solubility standpoint. In general, a comparatively large hydrocarbon group on the phenolic molecule is advantageous, for it increases the solubility in gasoline and decreases the solubility in water.

Pyrogallol and its alkyl derivatives are powerful antioxidants, but they have the disadvantage of too great solubility. In this investigation it was found that when the alkyl group contains no more than four carbon atoms the effectiveness is increased and the solubility diminished. Pyrogallols of this type are found in certain hardwood distillates.

Determination of Olefins in C_3 and C_4 Hydrocarbons—B. R. Stanerson and Harry Levin, before AMERICAN CHEMICAL SOCIETY, PETROLEUM DIVISION, Memphis Meeting, April, 1942.

A method is described for determining olefin content of C_3 and C_4 hydrocarbons by direct titration of sample condensed in cold chloroform. Bromine in glacial acetic acid is used for titration. The method has given satisfactory results on synthetic blends covering the complete range of unsaturation and is particularly suited for routine plant control purposes because of its simplicity and rapidity.

Hydrogen sulfide, mercaptans, and 1,3-butadiene interfere and must be removed before analysis.

Aniline Point Determinations with Dark-Colored Oils—A. S. Williams and E. W. Dean, in JOURNAL INDUSTRIAL CHEMISTRY, ANALYTICAL EDITION, Vol. 14 (1942), No. 1, pp. 63-64.

The aniline point determination on a transparent oil is easy to make, but when dark oils must be tested, turbidity is hard to detect, so various other schemes have been proposed and used; these are mostly makeshift methods which more or less fall short of being satisfactory.

In an aniline point test the temperature at which turbidity occurs must be accurately noted. For this purpose the authors have invented a circulating test tube. This tube is in the form of a U with a cross arm connecting the two limbs of the U a few inches above the turn. This cross arm is hollow and flat and constitutes a plane "cell" 1 or 2 millimeters thick and about 20 millimeters wide. The apparatus is filled with about 20 ml. of a mixture of the oil and aniline, an auger-type glass stirrer, actuated by a small motor, is placed in one leg of the U-tube and a thermometer in the other. The stirrer drives the liquid from the one leg to the other and back through the flattened "cell." By using suitable illumination the operator can easily note the appearance of turbidity and also the exact temperature at which the change occurs. With this apparatus it is possible to test oils which are considerably too dark for color determinations with either the A.S.T.M.-Union or the Tag-Robinson Colorimeter.

Determination of Thiosulfate in Used Doctor Solution—Karl Uhrig and Harry Levin, before AMERICAN CHEMICAL SOCIETY, PETROLEUM DIVISION, Memphis Meeting, April, 1942.

A method is described for determining thiosulfate in used doctor solution. It is based on the observation that carbon dioxide precipitates the lead and simultaneously converts any sulfite present to bisulfite which subsequently is bound to formaldehyde to render it inactive toward iodine. Under these conditions, thiosulfate is titrated alone.

Naphthene Ring Analysis—M. R. Lipkin and S. S. Kurtz, Jr., before PETROLEUM DIVISION, AMERICAN CHEMICAL SOCIETY, Atlantic City, September, 1941.

It is shown that the percent naphthene rings and percent paraffins plus paraffin side chains can be calculated on the basis of molecular weight and density or density coefficient and density with greater

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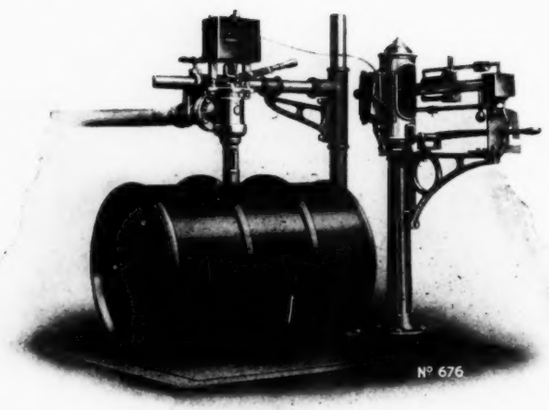

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accuracy than on the basis of the specific refraction chart used by Waterman. There are fewer assumptions involved in the molecular weight density calculation than in the specific refraction calculation. The method is good throughout the range of molecular weights for which data are available and can be used for cuts of wide boiling range. Naphthene ring analysis of 143 naphthenes of one to four rings per molecule and ranging from cyclopropane to cyclooctane type rings shows an average deviation of 7 percent.

Isolation of Sulfur Compounds from a California Straight-Run Gasoline—O. L. Polly, A. C. Byrns, and W. E. Bradley, before AMERICAN CHEMICAL SOCIETY, PETROLEUM DIVISION, Memphis Meeting, April, 1942.

The present investigation was undertaken to examine a product obtained by treating high-sulfur naphtha with anhydrous aluminum chloride at ordinary temperature. Aluminum chloride was found to remove sulfur compounds practically quantitatively in the form of a heavy fluid sludge, which was readily separated from the naphtha. Hydrolysis of the sludge liberated an oil which analyzed 20 weight percent sulfur. Seventy percent of the oil boiled in the original naphtha range. Close-cut fractions of this material yielded several thiopanes identical with those previously reported in the literature. Improved methods of segregating individual sulfur compounds are reported.

REFINING

Polyform and Gas Reversion Processes for Higher Octane Gasoline—E. R. Smoley and V. O. Boyles, before WESTERN PETROLEUM REFINERS' ASSOCIATION, Shreveport Meeting, October, 1941.

There are now 14 polyform and gas reversion process plants that process close to 100,000 bbl. per day of naphthas, propanes and butanes, in large part coming from the natural gasoline industry. Four other plants are building.

The authors discuss the octane number improvement that may be provided by applying these processes to naphtha. Straight run heavy naphthas may be polyformed to give high yields of 76 to 80 A.S.T.M. o.n. gasoline. Straight run gas oil, recycle gas oil, or catalytically cracked gas oils may be polyformed to 74-76 A.S.T.M. o.n. with good yields, and reduced crude may be polyformed to 70-72 A.S.T.M. o.n. Heavy cracked gasoline may be polyformed satisfactorily to 76 A.S.T.M. o.n. Aviation fuels which lead up to 91 A.S.T.M. o.n. with less than 4 c.c. of lead, and meeting all army specifications, may be made from the polyform process and these may be used as base stock with iso-pentane, alkylate or iso-octane for preparing 100 o.n. aviation gasoline. The polyform distillates are rich in aromatics containing toluene. The process also can be made to yield butylene as a by-product for making alkylate.

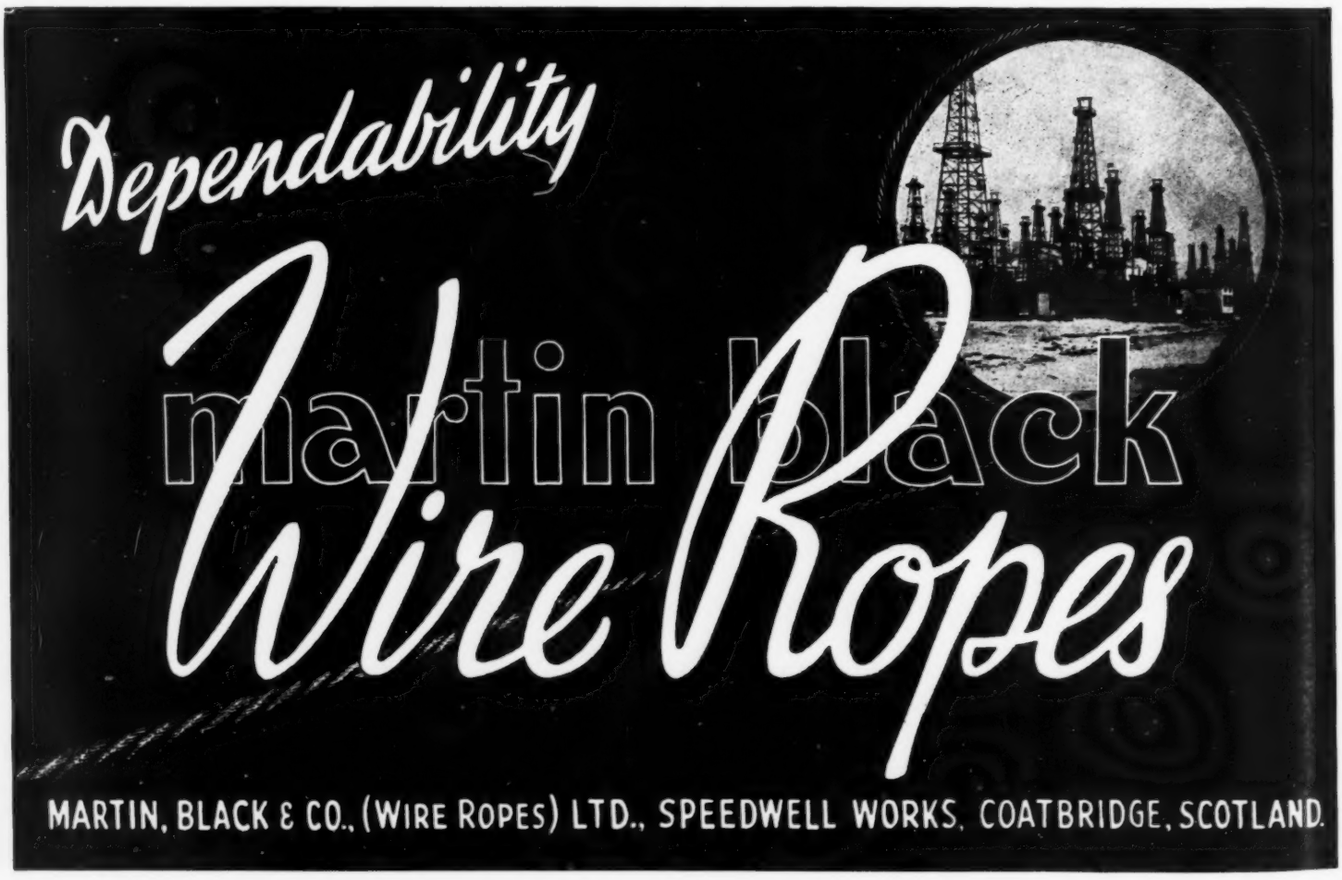
The use of natural gasoline in the direct manufacture of 100 o.n. aviation gasoline, simultaneously with high o.n. motor gasoline, by the polyform and gas reversion process, should interest natural gasoline manufacturers. For example, the case is put forward of a producer who has available 5,000 bbl. a day of 26 lb. casing-head containing approximately 3,000 bbl. of iso-pentane-free natural gasoline, 350 bbl. of iso-pentane, 1100 bbl. of normal butane and 550 bbl. of iso-butane. This stock would be separated into aviation base stock and a heavy naphtha. The naphtha would be polyformed with the normal butane to yield 1300 bbl. of 76 o.n. motor gasoline; at the same time a by-product butane-butylene stream would be charged to an alkylation plant along with the iso-butane to produce about 1,000 bbl. of 93-95 o.n. aviation alkylate. The latter would be blended with the iso-pentane and the aviation base stock from the original natural gasoline to give a net production of 1,850 bbl. a day of leaded 100 o.n. gasoline, and besides that, 2,300 bbl. a day of 73 A.S.T.M. o.n. motor gasoline.

A large polyform unit charging straight run naphtha of 250°-400° F. boiling range and about 45 o.n from mixed Texas and coastal crudes, along with outside propanes and butanes, has yielded 83.5 per cent of 10 R. v.p. 400° end-point gasoline with a Research o.n. of 81.0.

Reaction Chambers on Thermal Cracking Units—R. C. Mithoff and L. F. Shimansky, before AMERICAN PETROLEUM INSTITUTE, 22nd Annual Meeting, San Francisco, November, 1941.

In recent years the Standard Oil Company of California has installed auxiliary downflow reaction chambers on 8 cracking units having a total raw-feed capacity of approximately 90,000 bbl. per day. The results have been highly satisfactory.

In this paper correlations are presented relating reaction-chamber size with results obtained by the use of these chambers. It is shown that their use increases the severity of cracking of the gas-oil



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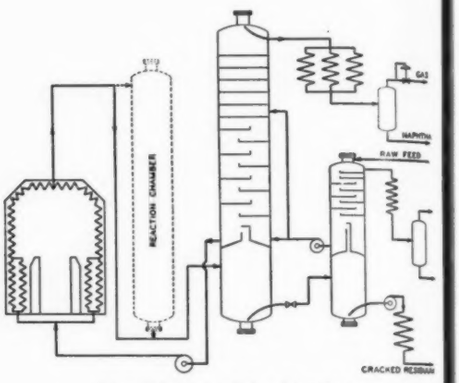
component of the raw feed, and decreases the severity of cracking of the asphaltic component. This results in production of cracked residuum of lower sediment content and increased viscosity, and of cracked gasoline with increased volatility and higher octane number. Use of chambers also results in increased plant capacity, due to decrease in the heat requirement for cracking, to reduction in tube coking, and to improve furnace conditions.

These advantages result in appreciable decrease in the manufacturing cost of cracked gasoline. It is believed that installation of additional reaction chambers on many of the cracking units in use in this country would be advantageous.



Flow Diagram of Cracking Unit.

The process is especially adapted to the cracking stock processed by this company, which is substantially heavier than most of the stocks processed in the East. The equipment is arranged as shown in the accompanying drawing.

Use of a downflow reaction chamber on a single-coil unit effects many of the advantages of two-coil operation when heavy oil is charged. The top transfer oil from the furnace is a mixture of liquid and vapor, and is discharged at essentially full cracking temperature into the top of the reaction chamber. The liquid constituents flow rapidly down the walls through the vapor, under the influence of gravity, to the bottom of the vessel, and promptly are ejected therefore in the combined liquid and vapor stream. However, the vaporized constituents of the oil from the furnace top transfer line drift slowly downward through the vessel, being forced forward only as additional vapor enters the top of the chamber. This situation results in exposure of the vapor in the chamber to cracking conditions for a period several times longer than exposure of the liquid. This means that, in the unit as a whole, the vapor is cracked appreciably more severely than is the asphalt—which is one of the main objectives of two-coil operation.

Use of a reaction chamber, therefore, allows the over-all degree of cracking in the unit to be increased without undue coking, because the chamber permits increase in the severity of cracking of the low-coke-forming gas oil, without increase in the severity of cracking of the high-coke-forming asphalt. This results in increased unit capacity, gasoline of improved quality, and cracked residuum of lower sediment content.

Bender Lead Sulfide Treating Process Proves Economical—LeRoy Eaby, in OIL & GAS JOURNAL, Vol. 40 (1942), No. 37, pp. 24-26.

In the well known doctor treatment, mercaptan sulfur is converted to the less objectionable disul-

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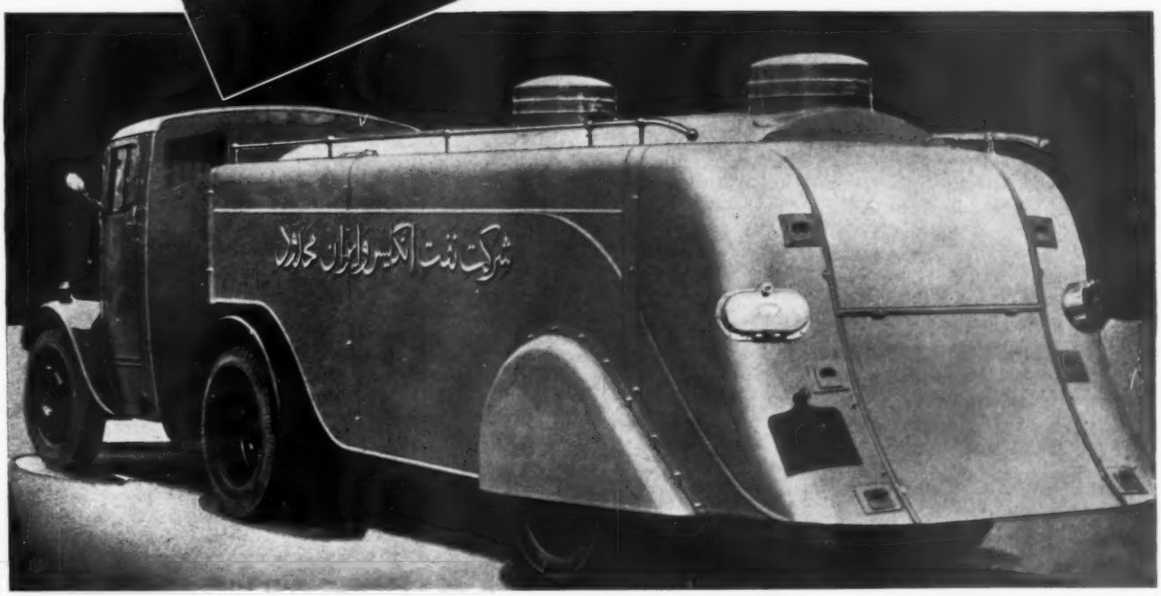

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fide form according to a chemical reaction which in theory is apparently a straightforward one, except that the conversion of mercaptan to disulfide per unit weight of sodium plumbite is observed to be greater than the theory calls for. Why so? Several investigators, and finally Bender, have found that lead sulfide, which is one of the products of the doctor reaction, has a definite catalytic effect in assisting certain side reactions, aside from the common doctor reaction. This led to discovery of a new type of doctor reaction which is expressed by the formula

$$2RSH + S \xrightarrow{PbS} R_2S_2 + H_2S$$

In words this formula says that when a mercaptan is mixed with sulfur in the presence of lead sulfide as a catalyst the mercaptan is converted into a disulfide and some hydrogen sulphide is set free. To make the reaction proceed in the direction of the arrow it is necessary to add just enough sodium hydroxide to convert the hydrogen sulfide into sodium hydrosulfide.

The refinery chemist will recognize the main difference from the usual doctor process: the use of sulfur instead of atmospheric oxygen. This will be a relief, as it is much less difficult to apply sulphur to a treating system than to efficiently inject air. However, the principal feature is the use of lead sulfide as a catalyst. This substance is fixed as a coating on pellets of a suitable material and a bed of the pellets is placed in a filtering tank through which the oil mixed with a small amount of caustic soda solution is filtered. As used in the Sinclair refinery at Marcus Hook, Pa., the catalyst bed has a long life, that is, a long economic life. It operates efficiently on any refinery product that requires mercaptan conversion. The treating units are relatively small and there is little loss of stock or chemicals.

Propane—A Substitute for Butane in Motor Fuels —R. C. Alden, H. M. Trimble and S. A. McReynolds in OIL & GAS JOURNAL, Vol. 40 (1942), No. 46, pp. 80-81, 122-223.

The question is raised as to what will happen to motor gasoline when all the country's butane is diverted to aviation gasoline and artificial rubber. The conclusion is that butane can very largely be replaced by propane.

It has been proposed that on account of its low boiling point, propane would increase the vapor pressure of motor fuel beyond permissible limits, and produce vapor-lock to annoy the motorist. This will not necessarily be the case. In an experiment a number of gasolines were debutanized and the volatility thus lost by the gasolines was restored to the same Reid vapor pressure with propane. It was found that the debutanized residuum after the vapor pressure was made the same again with propane, actually had a higher vapor-lock temperature (30° F. higher).

It is pointed out that the amount of butane in motor gasoline represents about 100,000 bbl. per day. If it were all withdrawn the lost vapor pressure could be replaced by about 28,000 bbl. of propane. By this substitution the refinery's output of gasoline would be reduced by about 45 percent. The propanized gasoline will not start quite as easily as butanized gasoline, the T.E.L. requirement will be slightly higher, and when the inclusion of propane amounts to the maximum of 4 percent for winter gasolines, the A.S.T.M. distillation recovery will be close to the often-encountered specification of 95 percent minimum. On the other hand, in containers with small openings the

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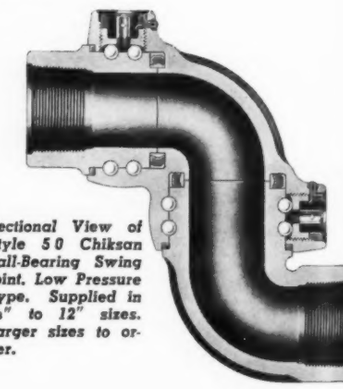

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butanized winter gasolines lose volume faster than the propanized winter gasolines.

Interesting By-Products from Hydroforming—M. H. Arveson, in OILS & GAS JOURNAL, Vol. 40 (1942), No. 36, p. 53.

Under the title "Hydroforming Process Now Used on Commercial Scale" the author refers to a by-product which represents an entirely new product. As is known, the hydroforming process consists of passing straight run petroleum naphthas over a catalyst at elevated temperatures and moderate pressures in the presence of gas containing hydrogen. A few percent of the product consists of a mixture of polycyclic aromatics that seems to be quite dissimilar to hydrocarbon mixtures from any known crude oils, coal tar oils, shale oils, etc. However, it has characteristics that seem to assure it various significant uses. It has especially useful properties as a rubber solvent, and in the manufacture of lacquers and other coating and impregnating compositions; as a solvent and plasticizer, and innumerable others. Hydroforming units now built or building could produce up to 15,000,000 gals. a year, or about as much as the total production of creosote oils, which is probably the most similar material as regards potential use.

Influence of Sulfur Compounds Upon Octane Number and Lead Susceptibility of Gasolines—Julian G. Ryan, before AMERICAN CHEMICAL SOCIETY, PETROLEUM DIVISION, Memphis Meeting, April, 1942.

Antiknock characteristics of gasolines are impaired by the presence of sulfur compounds to an extent dependent upon hydrocarbon structure and sulfur type. Susceptibility to tetraethyl lead as affected by structure of sulfur compounds has been investigated quantitatively. A relation which is independent of hydrocarbon composition has been established between concentration of various sulfur types and lead susceptibility. This mathematical expression permits accurate evaluation from group-sulfur analyses of the improvement obtainable by partial or complete desulfurization, the effect of gasoline-sweetening methods, and the effect of blending stocks of similar hydrocarbon composition but different sulfur contents.

The effect of sulfur compounds upon octane number in the absence of tetraethyl lead varies with size and structure of the hydrocarbon portion of the molecule as well as the sulfur type.

USES

Examination of Used Engine Crankcase Oil—L. L. Davis, in AMERICAN SOCIETY TESTING MATERIALS BULLETIN, December, 1941.

Like everything else, the serviceable life of an engine oil is not everlasting. But it is, or it should be, the object of every careful engine operator to obtain good oil and then to establish operating conditions that will insure its maximum usefulness.

The depreciation of an oil in service results from contamination from two major sources:

1. From sources external to the lubricating system. These extrinsic contaminants (such as those from the combustion zone) depend upon the mechanical conditions of the engine and are not a consequence of the kind or quality of the lubricant.

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Equipment will be available for only a limited number of wells in 1942—perhaps 19,000—of which one-third may be wildcats. The importance of conserving this equipment is now greater than ever before.

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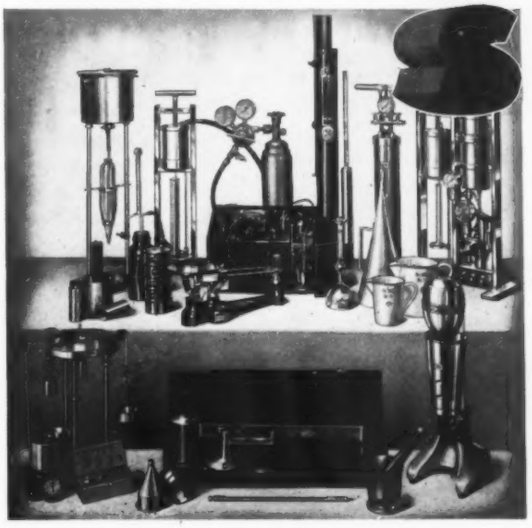
Tests of weight, viscosity, gel strength, water loss and other important characteristics of drilling mud should be made at frequent intervals with the Baroid Mud Testing Equipment shown below



Blow-outs, though infrequent, may be prevented, thus eliminating the loss of much valuable drilling equipment.

Stuck drill pipe, twist-offs, with resulting fishing jobs, and other drilling difficulties can often be prevented with large savings in equipment and time.

Thin mud cakes left on the walls of the hole by properly conditioned drilling muds minimize channeling when cementing casing and permit the placing of a uniform thickness of cement around the casing higher in the annulus, thus providing a better bond between casing and formation.

The continued use of Baroid Mud Testing Equipment enables an operator to keep the sand content and mud cake thickness at a minimum, thus reducing the strain on drill pipe and hoisting equipment and thereby prolonging their useful life.

Corrosion, with its injurious effect on all metal parts of the mud system, can be definitely checked with a drilling mud containing an adequate percentage of colloids.

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2. From sources inherent to the lubricating system and to the oil. These intrinsic contaminants result from the changes in the oil and therefore depend upon the quality of the oil as well as upon the operating conditions.

	Oil No. 1	Oil No. 2
Engine rating	14	19
Bearing corrosion	None	None
Neutralizing number	3.1	8.7
Naphtha insoluble, per cent	1.56	2.13
$CHCl_3$ insoluble, per cent	1.14	0.53
Asphaltenes, per cent by difference	0.42	1.60
Viscosity at 210 F.		
New oil	60.4	67.9
Used oil	67.9	110.6
Dilution, per cent	1.8	1.8
Water	0	0
Carbon residue, per cent	2.47	3.25
Carbon residue, filtered, per cent	1.45	2.05
Resin, per cent	5.85	14.25
Iron, per cent		
Total	0.014	0.031
Soluble	0.010	0.021
Lead, per cent		
Total	0.89	0.92
Soluble	0.06	0.78
True color	482	429

There are here stated two factors to be kept in view. The best of oils will fail to protect the engine if it is continued in use after it has accumulated oxidation products that attack the metal parts of the engine, or if the engine is operated without an efficient air filter to keep out abrasive dust. Neither will the oil give good service if bad engine conditions allow it to become contaminated with water or gasoline.

If these extrinsic conditions are what they should be, then the kind and length of service rendered by the oil will depend on the oil's inherent qualities. Much may be learned about a new oil from a chemical analysis, but more can be ascertained by analyzing the oil after it has been used. For example, the author quotes the analysis of two crankcase oils that were drained after 2500 miles of severe summer service in passenger cars of a popular make. Both oils were of the S.A.E. 30 grade.

This analysis discloses that by its high asphaltenes and neutralization number, carbon residue and resin content, oil No. 2 has been considerably oxidized, while these same characteristics and the low viscosity after use confirm that oil No. 1 has not been severely oxidized. No. 1 appears to be safe in all characteristics for continued use, while No. 2 is evidently due to be drained. Such an analysis of used oil, together with practical experience with representative oils, may enable the fleet operator to determine the correct drainage period, which should be substantially shorter than the indicated maximum life of the oil, and this period should be primarily based on engine conditions.

New Testing Methods for Lubricating Greases—H. Wefelscheid, in OEL UND KOHLE, Vol. 37 (1941), No. 13, pp. 263-240.

The director of research on bearings for the German railway administration announces some new practical tests on greases, which are said to be "unconditionally reproducible."

Consistence Test: The grease is placed in a closed container with a perforated false bottom; the space below the perforated bottom on which the sample is placed, and the space above it are separately connected with a vacuum pump through a two-way cock. After the sample is in place the two-way cock is opened so that the entire apparatus may be evacuated to 100 mm. of mercury, as shown by a manometer. Then the two-way cock is adjusted so as to admit air into the space above the sample while the vacuum is maintained below it. The grease therefore tends to be sucked into the lower space and the mercury in the manometer tends to rise in proportion to the amount of grease that passes through the perforated place, which again is in proportion to the softness of the grease. The time rate of the rise of the mercury is recorded by photographing the manometer at intervals and constructing a curve. Different temperatures may be used.

Separation Test: The sample is placed in an aluminum vessel 73 x 80 mm. having 271 holes 2 mm. wide in the bottom; 350 grams of grease are evenly spread on the bottom, and the outfit is suspended over another vessel at a temperature of 80° C. for 50 hours. The grease that has passed through is weighed and should not exceed 2 per cent (7 grams).

"Gel Test": This is a test for railway bearing greases, the necessity for which arises out of the following circumstances: When a grease box is opened after a run there may be seen a gummy cake. This is due to the fact that the solubility of the soap in the oil is not complete except at high operating temperatures; when a gel of oil and soap is formed at lower temperatures a part of

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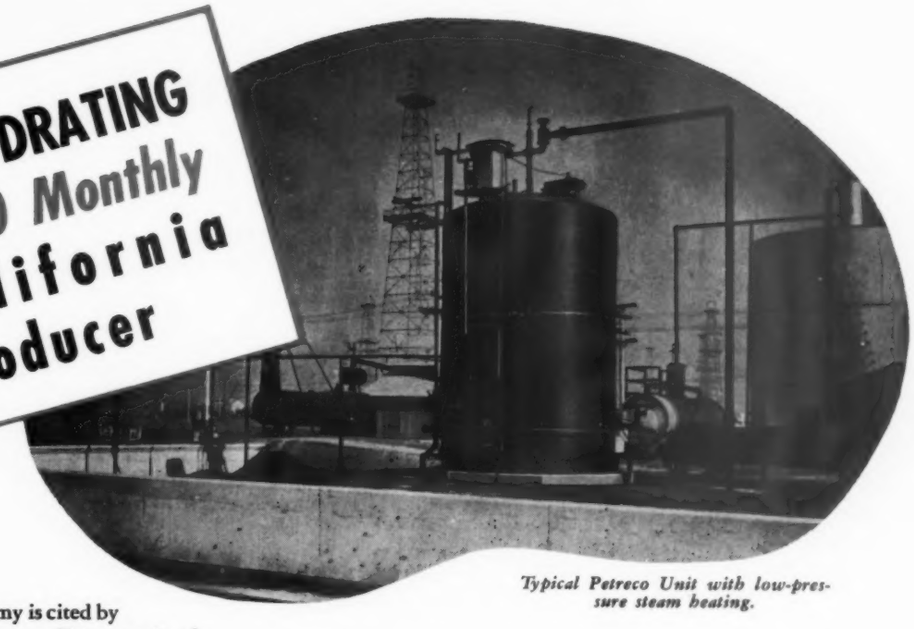

Typical Petreco Unit with low-pressure steam heating.

This impressive economy is cited by one California operator as a direct result of their Petreco installation. Before using Petreco dehydrating, they heat-treated their crude. This required the firing of a high-pressure steam boiler, with the attendant expense of fuel oil, feed water, service and attention. The excessive heating resulted in gravity and volume losses.

As a conservation and economy measure, Petreco engineers recommended a low-pressure steam heating system, with condensate return by gravity. There was sufficient lease gas available as fuel, eliminating the monthly fuel oil expense, and the condensate return virtually stopped water usage. In dollars and cents, the average monthly savings on heating costs alone were $298.00 . . . $255.50 for fuel oil, $42.50 for feed water. The elimination of the high-pressure boilers, and their necessary attention, released two men for full time service elsewhere on the lease. Since their wages were chargeable directly to treating costs, a saving of $330.00 was effected; the men relieved then being available for duty in another department.

In the Petreco vapor tight dehydrating system, the volume saving was estimated at 3%. This conservation of light fractions raised the shipping gravity of the oil from around 13.1°– 13.2° A.P.I. to 13.9°– 14.1° A.P.I. (Before the Petreco unit was installed, no 14° A.P.I. oil ever had been shipped from this lease. With Petreco processing, approximately 30% of the production was shipped at 14° A.P.I.) The 3% volume saving, plus the higher selling price earned by the 14° A.P.I. shipping gravity, resulted in an average monthly saving of $332.80. This, plus the saving in heating cost already cited, totaled a net of $828.80 per month . . . *over and above* the moderate Petreco treating cost.

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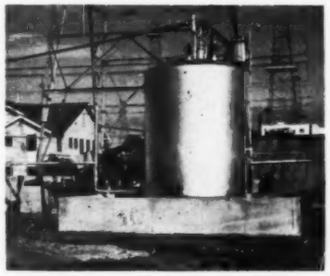
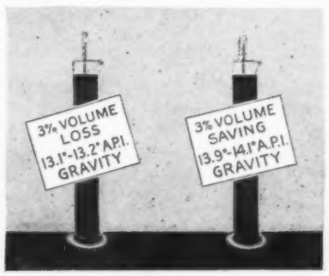


The Petreco Electric Dehydrating Process is flexible and can readily be tied in with lease production methods.



Gravity and volume conserved by the Petreco vapor tight flow system resulted in $332.80 monthly saving.

Petreco research and engineering personnel are available twenty-four hours a day to help producers obtain the highest dehydrating efficiency.

PETRECO

DEHYDRATING DESALTING

the soap again separates and the gel character disappears. For determining this gelling property the following test is used: First, a sample of the grease is packed into an 80 x 73 mm. cylinder provided with a perforated screen bottom. Vessel and grease are placed on a tripod and kept at 80° C. for 24 hours to separate a portion of the free oil. Thereafter the wad of grease remaining is placed between the two halves of a horizontal split cylinder. These two halves are hinged together on one edge but are free on the other edge. The upper half-cylinder carries a pointer which may pass over the face of an upright scale. When the wad of grease is in position the upper half of the split cylinder is pressed down so as to lower the pointer a distance of 5 millimeters on the scale. Pressure is removed and the position then assumed by the pointer is taken as the zero point. The pointer is then depressed 10 mm. more; any rebound is taken as a measure of gel formation.

Studying Combustion in the Diesel Engine by Additions of Gaseous Combustibles to the Intake Air—Martin A. Elliott and L. B. Berger, before AMERICAN CHEMICAL SOCIETY, Memphis Meeting, April, 1942.

In a study of the effects on exhaust gas composition of adding natural gas to the intake air of two commercial Diesel engines, information was gained incidentally on certain phases of combustion in this type engine.

The results furnish evidence indicating that intense combustion in the Diesel engine probably occurs only in regions in which the local concentration of fuel is at least equal to a certain minimum value analogous to the lower limit of inflammability. These regions are designated as "overlean" because inflammation does not occur in them, although direct oxidation reactions are taking place. The importance of locally overlean regions as the source of carbon monoxide and aldehydes in the exhaust gas at fuel-air ratios less than the chemically correct value is pointed out in discussing the variation of the concentration of these constituents with fuel-air ratio. The analysis of data on the concentration of oxides of nitrogen in the exhaust at different operating conditions disclosed the possible relation of certain of the observed effects to the conditions existing in regions of intense combustion.

Most of the information on combustion was made available as a result of seeking explanations for effects observed when natural gas was added to the intake. Accordingly, this suggests the possibility that the addition of combustible gases to the intake air of a Diesel engine might offer a valuable new technique for studying certain aspects of combustion in this type engine.

GENERAL

Ignition Possibilities of Mineral Oils—Karl Sperling, in OEL UND KOHLE, Vol. 37 (1941), No. 18, pp. 329-333.

This paper relates to circumstances that may give rise to undesired ignition of mineral oils in operations where they are handled and refined. Everybody knows that oil will burn, and most oil technologists are acquainted with the concepts "flash point" and "fire point." But these concepts do not cover all the numerous circumstances that may start an oil fire.

The Hamburg Fire Department made a series of experiments on the subject.

1. Balls of cotton were saturated with light gasoline, and with a gasoline-benzene mixture; sparks struck from iron on steel, iron on stone, steel on emery, stone on emery, and copper on emery failed to produce ignition, but sparks from a gas lighter (cerium on steel) promptly took effect.

2. Samples of gasoline, crude oil, diesel oil and motor oil were exposed to streams of sparks from an emery wheel which was grinding carbon steel, tool steel, stone, copper, and cerium-iron alloy. Only the gasoline was ignited, and that only by the cerium-iron alloy.

3. Oil products in shallow dishes at ordinary temperature, or heated to boiling or soaked in cotton, were exposed to electric sparks produced by an auto battery. In all cases gasoline was immediately ignited; cold petroleum was not ignited, but took fire when boiled or when soaked on cotton; diesel oil and motor oil ignited only on cotton after long exposure to the sparks (cotton by itself ignited quickly).

4. Small amounts of oil were spread on pieces of iron or copper heated to known temperatures. On iron, light gasoline ignited at 720° C., gasoline-benzene at 740° C. On copper, these same products ignited at temperatures between 520° and 570°. Evidently, hot copper will set fire to oil at a lower temperature than iron. Perhaps copper ac-

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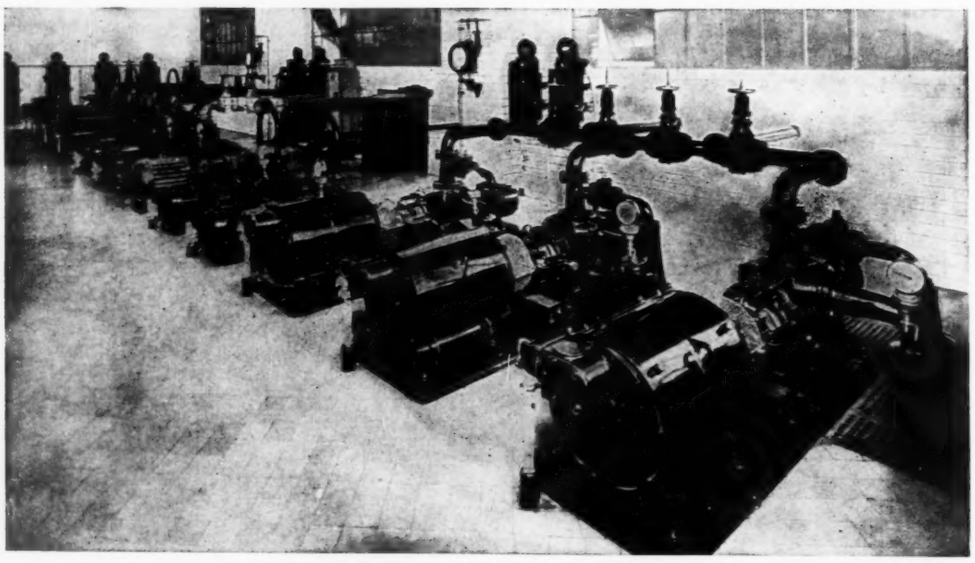

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celerates the ignition by some catalytic process.

5. In this series motor and diesel oils previously heated to 400° C. were dropped on a steel tube heated to known temperatures. In all cases fire resulted, at temperatures ranging from 410° to 470°. It is thus evident that hot oil and hot steel add up to a definite fire hazard. It appears that lubricating oil used in this experiment had a lower ignition point than the diesel oils.

The general conclusion is that from the standpoint of fire prevention, mineral oils should not be heated in the open more than is strictly necessary. Plants and equipment should be built so that in the event of leaks hot oil will not come in contact with hot steel, and especially not with hot copper. Liberal use should be made of insulation, and electrical sparking avoided by grounding.

Substitute Fuels, A War Economy of World Dimension—Gustav Egloff and P. M. Van Arsdell, before AMERICAN CHEMICAL SOCIETY, PETROLEUM DIVISION, Memphis Meeting, April, 1942.

With the United Nations in the possession of 90 percent of the world's oil, the fuel situation for the Axis-controlled nations has involved the use of many substitute motor fuels. Hydrogenation of coal by the Bergius and carbon monoxide by the Fischer-Tropsch process has been responsible for 43 percent of the oil used by Germany for war purposes. The other substitute fuels, compressed gases, alcohol; wood- and coal-burning automobiles, trucks, buses and boats; shale, and miscellaneous fuels have not been as important in military usage as the liquid fuels, but they are used exclusively by the civilian population since no liquid fuel is available. Altogether the substitute fuels and petroleum have made 122,700,000 barrels of fuel available to the Axis countries.

At the end of 1941 it was estimated that there were a total of 107,225 compressed gas vehicles which released approximately 2,553,000 barrels of liquid fuels, and a maximum of 373,143 producer gas vehicles in use in Europe, which saved about 7,780,000 barrels of oil fuel. Approximately 13,200,000 barrels of benzol and alcohol were produced on the European continent in the same period and 233,000 barrels of shale oil also had been produced. Sweden and Spain planned to produce greater quantities of shale oil from their undeveloped resources.

The cataloguing of the other substitutes shows that man has availed himself of animal, vegetable, and mineral products to run his motor vehicles on all the continents of the world. The only energy givers so far untapped for direct use in a motor are sunlight and atomic power, and the chances are when human ingenuity can rise to the occasion, even these too will be used.

The Question of Petroleum Reserves—Prentiss I. Moore, in PETROLEUM ENGINEER, Vol. 13 (1942), No. 9, pp. 33-36.

Some commentators put out the statement that, theoretically, the United States has 12 or 14 years' proved supply. Theoretically, this may be correct, but practically it is decidedly erroneous. There may be and undoubtedly are 19 or 20 billion bbl. of oil in the underground reserves, enough at the present rate of consumption to last 12 or 14 years, but this oil cannot all be recovered in those 12 or 14 years. All past history of the oil business proves that recovery is a gradual and extremely long-drawn-out process. Some of the oil now counted in recoverable reserves will still be in its subterranean beds 50 years from now, or longer, in spite of anything the oilman can do to produce it in a hurry. And the more he hurries the more likely is he to dissipate the natural energy of the oil pool, and so diminish the total that may be recovered by approved methods.

Even long before Pearl Harbor it was apparent that the rate of consumption was drawing ahead of the rate at which new reserves were being discovered. Should World War II be a long one, or should the enemy successfully attack the near East, sources of petroleum, increasing demand on the United States would accelerate the depletion of the oil reserves of this country. The amount of oil which could be drawn from our pools quickly is highly problematical on account of the potential damage that might be done to the fields. Experienced engineers are inclined to the belief that there would be many bad surprises in the oil States if all prorated fields were given a few days open-flow test. All that can be said is that the United States has available petroleum in abundance for any conceivable emergency—for awhile. The question about the next 10 years is something else, and the something else is likely to prove disagreeable unless the rate of discovery is again brought up to if not ahead of the rate of consumption. To do that, it will be necessary to assure that drilling for new oil shall be encouraged by a good price.

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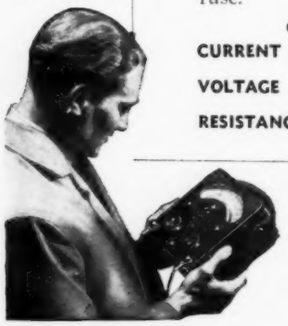

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